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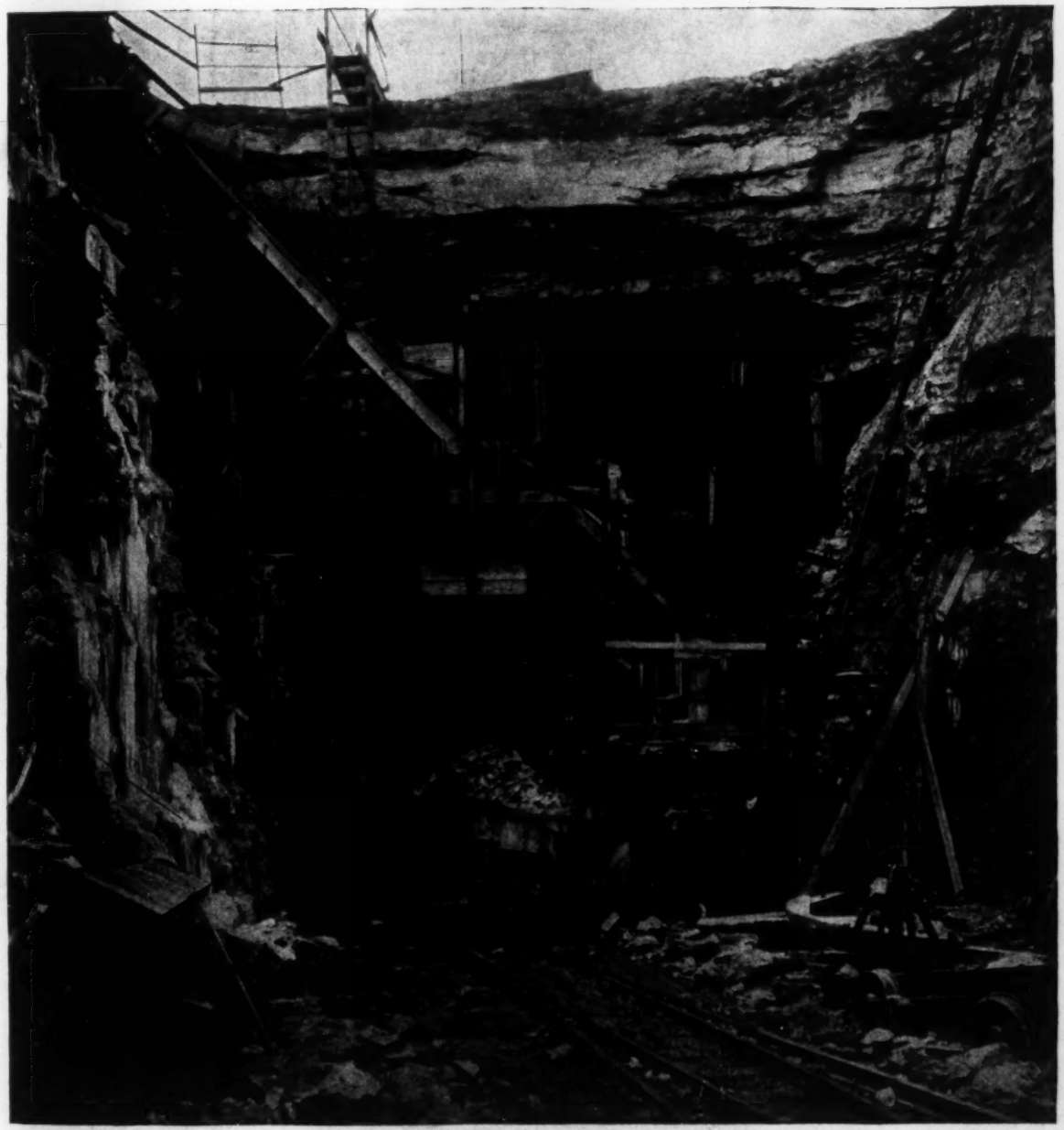

Working at Portal of Kansas City Flood Protection Tunnel

In This Issue:—Largest Earth Dam—An American Engineer In Soviet Russia—New York's Most Extensive Pier Group—Driving Big Flood Protection Tunnel

Monthly Labor and Material Prices—Construction Cost and Construction Volume Index

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ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

E. J. MEHREN, Editor

Volume 87 — NEW YORK, DECEMBER 1, 1921 — Number 22

Bringing Pressure for an Economic Conference

INSISTENT are the demands that the disarmament conference resolve itself, when its naval and Far Eastern programs are disposed of, into an economic conference. Rumor has it that this will be Lloyd George's proposal should he come here. But it should not be Lloyd George's proposal merely; it should be the proposal of every American business man and engineer as well.

We need naval disarmament, we need a settlement of Far Eastern questions, but we need above all—because of their immediate pressing importance—a solution of the problems that flow out of the financial difficulties of continental Europe. This economic breakdown is daily unsettling international trade, and the dire consequences of the possible bankruptcy of Germany no man can clearly forsee. No single nation can stop the downward course of things; it must be done by international agreement.

Preceding an economic discussion, however, whose end result would be the stabilization of exchanges, must come the balancing of budgets, for otherwise the printing of paper money cannot be stopped. The balancing of the budgets, then, is the crux of the situation and their unbalancing is due to the maintenance of their land armaments. In fact, the cost of these land armaments is almost exactly equal to the amount by which the budgets are out of balance.

The first step, then, is to resolve the Washington conference, after the naval and Far Eastern questions are out of the way, into a land-disarmament meeting. Land disarmament is, indeed, on the present agenda, but unless the influence of the public is brought to bear it may not be taken up. If substantial land disarmament be agreed to, the budget balancing will not be exceedingly difficult, and stabilization, necessarily involving a temporary respite in German indemnity payments, will be easy.

American business men then—and the engineers with them, as an integral part of the business structure—should being their influence to bear upon the President and his cabinet to secure a consideration of land disarmament and then of the European economic ills which are unsettling the world. These are the foremost business questions—and business hindrances—of the day. It is the duty of American business men to demand that these hindrances be removed by international co-operation, flowing out of international conference.

It is a time to act.

November Highway Contracts

WHETHER the general appeal that highway contracts be let early as a part of the unemployment relief program has been heeded, or whether the volume of highway construction in 1922 is to surpass any preceding year, is difficult of determination from available figures. But the fact remains that during November the value of highway contracts was almost double in volume that of any previous year. A multiplicity of forecasts and explanations may be deduced from the comparative figures of the past three years. Here they are: 1919, $11,270,000; 1920, $12,443,000; and 1921, $20,750,000.

Volume of Construction

CONTRACT values for all classes of construction have been as high as for street and road work. In money involved the figures for November, 1920 and 1921 are, in round numbers, $76,000,000 and $97,000,000 respectively. However, in comparative volume, the past month has doubled the same month of 1920, for the *Engineering News-Record* Construction Volume Index Number is 101 for this November as against 51 for last. Reiteration of a former assertion that the construction industry is not in as bad a state as the popular mind would have it, seems pertinent. Even though 1913 may have been a slightly subnormal construction year, the index number for November shows a volume of building done equal to the average month of 1913. Part of the cry that construction conditions are bad may be explained by the inability of business men to forget the fat war years. Like the ghost of Banquo, its shade will not down.

Jail for Material Ring

AT LAST members of a material ring in the building industry have got their just deserts. A federal judge sitting at New York passed sentence last week upon four tile and mantel contractors who had pleaded guilty to violations of the Sherman anti-trust law. They had been guilty of restraint of trade and the judge deemed their cases so flagrant that he refused to let them off with fines. This is the proper medicine to apply in these cases. The building material rings—both on the part of the material dealers and on the part of labor—have been extremely flagrant at New York. Severe punishment is called for, and Judge Van Fleet proved equal to the occasion in four cases last week. Fifty-two of the offenders, however, were let off with fines of from $500 to $5,000.

To the Point

BECAUSE a time limit was set and observed for the score or more of papers at the meetings on sanitation problems held by the American Society of Civil Engineers in recognition of the Jubilee convention of the American Public Health Association two weeks ago, the papers themselves were unusually interesting and ample time for discussion was afforded and utilized. The three main topics—sewage, odor, water—were

ably presented from various aspects by well chosen speakers, not one of whom droned on far beyond his time limit, regardless of the rights of other chosen speakers and of those who wished to take part in the general discussion. Program framers and speakers alike for other technical society meetings may well heed this object lesson.

Virgin Fields

ALERT-MINDED listeners at the meetings just noted, as well as those of the sanitary engineering section of the American Public Health Association (see brief abstracts of papers before each, elsewhere in this issue) were impressed with the many almost virgin fields for sanitary engineers and allied workers now open or awaiting the pioneer. These opportunities are most evident in connection with water and sewage treatment, because the much that has been accomplished here shows more clearly every day no end of unsolved problems. The same is true of garbage disposal, although this may not be so clearly evident to more than a very few, because as yet not all sanitary engineers—much less city officials and the general public realize that garbage disposal is an important branch of sanitary engineering, or else there would be more than the present half dozen engineers specializing in that field.

Odor Engineering

NEWEST AND FREEST from able competition is the field of odor engineering. This is so closely associated with the sanitary control of other nuisances, that nuisance engineering might be a better although a less catching term. Besides being intimately connected with sewage and garbage disposal, particularly the latter, there has of late been a large and rapidly growing volume of complaints and litigation over the odors produced by a variety of industrial plants, notably oil refineries. The control of these and many other odors requires a theoretical and practical knowledge of various branches of civil and mechanical engineering, chemistry, bacteriology in some cases, meteorology and both physiology and psychology. Odor or nuisance engineering should attract the younger engineers because of its novelty and their adaptability to adventure, and also the older engineers having a background of experience, mature judgment and knowledge of men and of courts—for much of odor engineering practice will be before the courts or semi-judicial bodies like state departments of health.

Diplomacy in Labor Organization

IT HAS been repeatedly pointed out that many of the difficulties between capital and labor are due to the fighting executives on either side. They have been developed in a day when only through a show of strength was it believed that a satisfactory settlement could be secured. As was to be expected upward progress has been more rapid among the employers, and there have been repeated pleadings that there were needed in labor ranks broadminded leaders whose strength lay in their knowledge and diplomacy rather than in their muscles and in their jaws. England, so it is stated by Mr. B. S. Rowntree in a statement to this journal, has worked through its labor experiences to this point. The old style of strong armed and loud voiced labor leaders is disappearing—in fact, has disappeared—from many of the trades unions. Instead there has arisen the conciliator and diplomat, who plays fair and whose strength lies in a showing of facts. With this type of leader, Mr. Rowntree states, it is easy to deal satisfactorily. In his own plant of 7,000 employees, dealing with such leaders, there has never been a strike, while one of the recent labor adjusters assured him that there had never been a strike in any plant in which he had conducted the negotiations and that within two months of the time he was speaking seventeen disputes had been satisfactorily settled. We must recognize, of course, the difference between the situation in England, where labor is much more largely unionized than here, and in the United States. Nevertheless, the method of conciliation of trying to work in fairness should be quite as productive here as abroad. It means a tremendous change, however, in the type of leadership rampant today in the American Federation of Labor and its subsidiary organizations.

A British View of American Roads

THANKS to the custom of the American daily press in interviewing notable foreign visitors, we have frequently been able to see ourselves and our cities in the mirror of European opinion. Such impressions, however, have generally come from statesmen, opera singers, bankers, soldiers, artists—almost every one except the engineer. Their comments, for the most part, have related to New York—its skyscrapers, hotels, the subway jam—and the personal characteristics of the American woman. We have had very little frank comment on our engineering practice. In this issue, however, Mr. Dryland, county engineer of Middlesex, England, who spent a month in this country last summer, presents a number of interesting and valuable impressions of our roadbuilding methods and problems of highway transport. Backed by forty years of experience in English highway construction and maintenance his views on our work offer much food for thought. American highway engineers, during the last few years, have made no effort to conceal their anxiety over the increasing number of heavy motor trucks. Nevertheless, any one who feels that the present weight and volume of traffic are near the peak of development should heed Mr. Dryland's warning that "our troubles are only beginning." The English road authorities, today, are being called upon to provide for much heavier weights than are American engineers. A disturbing factor in the London suburban districts is the surprising development of traffic by buses and charabancs, the latter passenger-carrying vehicles accommodating about fifty persons and of a type comparable to our "sight-seeing" automobiles. If American experience is to duplicate that of the English counties, our highway engineers have much to think about in planning new road types for heavier loads than are now common. Mr. Dryland's article is valuable chiefly in the stimulus it will give to the study of highway transport problems not only of today but of tomorrow.

Proposals for Engineering Services

THE iniquity of the practice of engineers bidding against each other in answer to proposals for engineering services lies largely in the temptation to cut fees to such an extent that good work cannot be done. Much of the lay complaint of poor work arises from the fact that the engineer was chosen on a low-price basis rather than on his technical qualifications. Remedial measures have been discussed for many

years, mostly behind closed doors. However, not until each engineer is activated sufficiently to do his bit in educating the public whenever the occasion arises, will the practice of city officials of advertising for engineering service on a bargain-counter basis be eliminated. Engineering society codes of ethics forbidding members from bartering their professional talents purely on a money competitive basis are of little use unless they are applied.

Engineers do improve the opportunity, perhaps more frequently than is realized. When George Champe, a civil engineer of Toledo, was sent a 3-in. advertisement asking for proposals for competent engineers for the preparation of plans, surveys and supervision of the proposed water-works improvement in Wellsville, Ohio, he wrote the director of public service as follows: "I am sure that you would not employ this method of securing a comptent physician for your family, or if you did, the physician who responded would probably not be very competent. Nor would you employ this method of securing an attorney if you had an important case in court. I am, therefore, very much disappointed that you should expect the engineers to enter into unprofessional bidding and that I cannot hope to serve you in the proposed improvements."

When every ad of this kind brings to the advertiser an avalanche of letters like Mr. Champe's, better methods will prevail.

The Halting Recessional of Russia

RECENTLY reports have been coming out of Russia to the effect that the Bolshevik government had lost faith in the ability of the Communistic era to restore the country's industrial life and was granting private concessions for the development of natural resources and the operation of industries. The reports have been true, but when the circumstances attendant upon the grants—or proposed grants—of these concessions are known it is realized that Russia's re-conversion to a property-rights regime is not whole hearted. Her recessional is halting.

The situation is made clear by a copy, just at hand, of a proposed contract between the Bolshevik government and an English company which was seeking, under the supposed new order, a concession to resume charge of its own mines. After protracted negotiations, in part with Krassin, the Bolshevik representative in London, and in part with Bolshevik officials in Moscow, the English company found it impossible to accept the terms and withdrew from the negotiations.

It should be remembered that the company in question was not an adventurer willing to take long chances in a very greatly disturbed field of operations. It had for years operated the properties, and sought merely to reassume control. Its withdrawal from the negotiations was due to the Soviet insistence upon absolute control of personnel and every feature of the operation.

For example, the clause governing labor was such that no guaranty was to be given to the concessionaire that those employed would be allowed to remain on their jobs. The laws permit of searches, arrests, extraction of papers or documents, etc., to be made at the will of the local authorities, while workmen are subject to labor conscription and may, no matter what their skill, whether manual or intellectual, be put at any class of work. In fact, it is standard practice to put skilled men at quite menial labor.

Again, the Soviet government demanded that the third, and customarily neutral member of the arbitration commission which was to settle disputes as to the meaning or fulfillment of the agreement be a Russian. This the company refused to accept, for it would run the risk of having the third man a Communist, who, for obvious reasons, could not be expected to render justice to a capitalistic organization. Even if he were not a member of the Communist party, no man is free in Russia today and being subject to labor conscription, to every kind of restriction in his home and movements, he is always in a position of subjection to the Communist state. In fact, he and his family are dependent for their daily ration of food on the pleasure of the government.

Moreover, had the company entered into a contract minus an arbitration board, it would have been subject to the operations of the regime as it is. Since this regime does not recognize any obligations between individuals, no contract or obligation between parties can be enforced, nor does the state itself recognize any obligation to individuals or subjects. The only obligation recognized and enforced is the absolute subjection of every individual to the state. The contract, therefore, without an arbitration board would have been a mere scrap of paper. In fact, in the light of Mr. Keeley's characterization of the Bolsheviki in this issue, there is doubt as to the value of any contract.

Finally, engagement of all persons was to be governed by a supplemental agreement made between the company and the All-Russian Council of Professional Unions, a mis-named organization to which all workers, even laborers, must belong. Under this proposed agreement all engagements and discharges were to be subject to the approval of the unions. The consequent restriction upon the freedom of the concessionaire in operating and developing his enterprise is evident. Further, the unions insisted that the concessionaire bring all of the supplies for the personal needs of the workmen and their families from abroad, this to continue for not less than seven years. Though it was pointed out to the unions that this would require the bringing of food from America and that there was surplus food in a neighboring province which the Soviet government was unable to move, the unions insisted upon these terms.

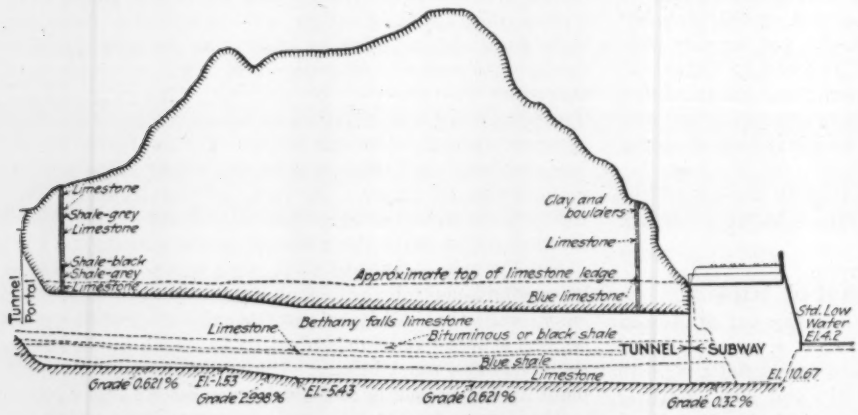
All in all, it was apparent that the contracts proposed by the Soviet government were not drawn in the interests of the workers, nor were they intended to give the concessionaire a sufficiently free hand to enable him to operate the property efficiently. The sole object seemed to be to keep undisputed control of the operations, despite the intent implied by the letting of a contract, in the hands of the Soviet authorities.

It is apparent, then, that while Russia is forced to relinquish something of her strictly Communistic theories, she has not yet gone far enough on the road to make her proposals inviting to outside capital. With the start away from pure Communistic theories, however, it is to be hoped that the time of the break-up is not far away. It is known that Lenin and Trotzky are getting farther apart, the former leaning toward a modification of the ultra-radical doctrines and the latter holding fast to them. The break in the lines cannot come too soon for the good of Russia and for the rest of the world, which needs for healthy trade restoration the consumptive power and the productive ability of the Russian people.

Driving a 20,000 Sec. Ft. Flood Protection Tunnel

Turkey Creek Diversion Works at Kansas City Includes 28 x 28-ft. Tunnel Through Bedrock Requiring Grade Change—Shovels Air Driven—Machine Mixed Concrete Placed by Air

FLOOD prevention measures at Kansas City which have been under way for some years involve among other things the diversion of Turkey Creek with a maximum estimated flow of 20,000 sec.ft. through 500 ft. of open channel, 1,300 ft. of 28 x 28-ft. tunnel and 200 ft. of concrete box "subway." A general description of the flood prevention program appeared in *Engineering News*, December 26, 1912, p. 1194; this article is devoted mainly to the construction operations in driving the tunnel, with particular reference to the grade change to avoid bedrock, the use of air driven shovels and the method of placing the concrete.



PROFILE ON CENTER LINE OF TURKEY CREEK FLOOD DIVERSION TUNNEL

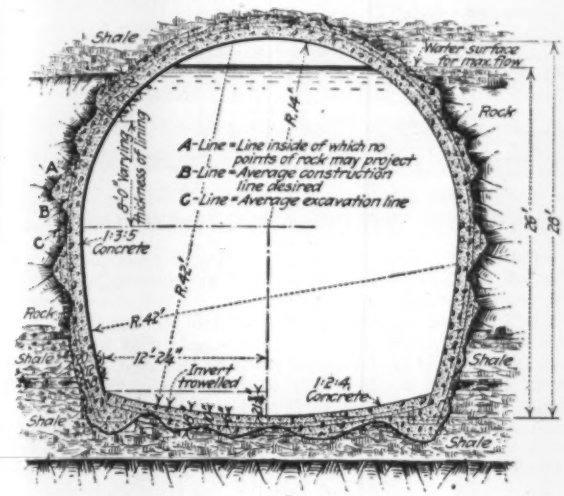
Turkey Creek is a comparatively small stream rising in the hills south of Rosedale, Kan., through which it flows across a corner of Kansas City, Kan., continuing across the state line into Kansas City, Mo., finally crossing the state line again and emptying into the Kaw River within the city of Kansas City, Kan. It drains an area 13 miles long and 2½ miles wide embracing about 15,000 acres. Outside of the cities the drainage area consists in general of rolling lands with precipitous slopes; within the cities the land is much flatter, but the paved streets and sewers occasion equally rapid concentration of rainfall. Ordinarily there is little flow in the creek (less than 10 sec.-ft.) but at high water periods the creek formerly overflowed its banks in its lower reaches and caused large flood damages to residence, business and railroad property adjacent. The principal floods in recent years occurred in 1903, 1906, 1908 and 1914.

The flood of September, 1914, was caused by an excessive rain on Sept. 6 and 7. Government records at Kansas City, Mo., showed a rainfall of 7.02 in. between 11 p.m. Sept. 6 and 10 a.m. the next day. It is thought that the rain was even heavier than this in the Turkey Creek watershed though no data covering this is available. This flood covered the valley to various depths up to 10 ft. and spread out over the low lands south of the mouth of Turkey Creek to sufficient depth to overtop the levee along the Kaw River destroying it in several places. But earlier floods had demonstrated the necessity of protection for overflowed land, and in 1910 Kansas City, Mo., began active work in the development of a suitable plan. Such a plan involved not only the protection of property from floods due to rains over the Turkey Creek watershed but also protection from back water from the Kaw River. Any diversion of Turkey Creek necessarily also involved provision for the sanitary and storm sewage then being discharged into the creek.

A comprehensive plan, generally spoken of as the Ash or Tunnel plan, was accordingly developed during 1910 and 1911 by L. R. Ash, then city engineer. [It is said the original idea came from J. E. Hutchison, general manager, St. Louis-San-Francisco Ry.—EDITOR.] The plan contemplated the diversion of Turkey Creek by a dam across it just below Ely Road (now Packard St.) in the city of Rosedale, Kan., a tunnel through Greystone Heights to carry the diverted stream into the Kaw River and a sewer commencing below the dam to carry the sanitary and storm sewage of this lower reach into the Kaw River. This plan involved also the reclamation of the area in Missouri then occupied by Turkey Creek; more than 11 acres was thus to be made available to the railroads and Stock Yards Co., owning the contiguous property. Owing to the several interests involved sufficient co-operation and funds were not available to start work for eight years after the project was launched, although the damage in the meanwhile had equalled about half the cost. The diversion was completed in 1920.

Capacity.—The tunnel and the improved creek channel above the tunnel provide a maximum capacity of 20,000 sec.-ft. corresponding to a run-off of 1⅓ in. per hour from the drainage area of 15,000 acres. This amount of water can be discharged for all stages of the Kaw River at the tunnel outlet up to El. 29. (Kansas City, Mo., datum.) During a flood in the Kaw River equivalent to the 1903 flood, with an elevation of water surface in the Kaw River assumed 3 ft. below the top of the levee at El. 37, this capacity will be reduced to 15,000 sec.-ft. Both of these capacities are based on the water surface in the open channel at all points being at least 3 ft. below the top of levee, so that the actual possible discharges before overtopping of levees would occur, are in excess of the given values. El. 29 corresponds to the 1908 flood in the Kaw River which is the flood next highest to the maximum flood of 1903.

The work consists of straightening, enlarging and diking the existing channel of Turkey Creek from the Frisco railroad bridge north of Southwest Boulevard in Rosedale to a point just east of Valley St. about 5,600 ft. downstream. At this point a diversion dam was thrown up in line with the east levee and the new channel, tunnel and "subway," constructed from the diversion dam through Greystone Heights into the Kaw



TYPICAL TUNNEL SECTION

River, a total distance of about 2,000 ft. Beyond the subway, flanking retaining walls were constructed as a protection for the Kaw River levees from Turkey Creek waters.

Open Channel, Levees and Dam.—The new open channel follows the general line of the old channel and has substantially the same bottom elevations as the old creek. This bottom is generally in rock which was found at a suitable elevation. Near the dam this rock drops too low and the bottom is in clay. The west bank is high ground thus requiring no levee protection; the east bank is lower and levees were required throughout. These levees were constructed out of the material from the channel excavation and are backed up for a portion of their length by spoil taken from the tunnel. For about 3,000 ft. beginning at the upper end the levees were thrown up adjacent to the existing Frisco railroad tracks instead of following closely the new channel, and were in effect merely a widening and a raising of the existing railroad embankment. The top width of the levee here was made sufficient to serve for a single track railroad with a portion widened with excess channel excavation sufficiently to give double track facilities. The balance of the levee departed from the railroad track, followed the channel and was constructed with a top width of 10 ft. and side slopes of 2 to 1. The upper portion of the levee adjacent to the railroad tracks was not protected but the lower narrower portion was protected throughout with hand laid stone revetment.

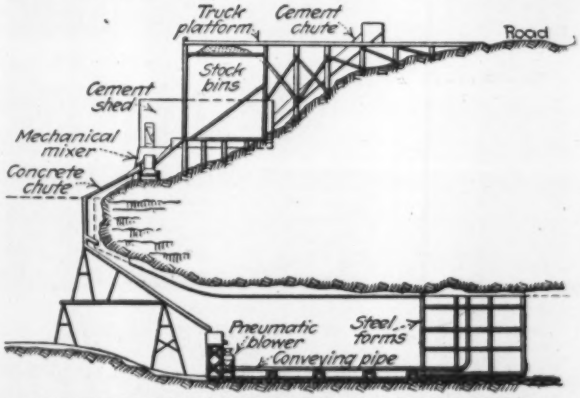
At its upper end the open channel was constructed with a bottom width of 90 ft. and side slopes of 2 to 1. This channel was narrowed and deepened in several stages as the tunnel was approached, and final section just outside the tunnel having a bottom width of only 25 ft. and side slopes in rock of ¼ to 1. Between the dam and the tunnel the channel was lined with concrete both on sides and bottom. The section was largely in rock and shale and the lining was anchored to the rock with anchor bolts.

In effect the dam is merely a part of the levee, but was constructed of more liberal dimensions and is better protected. It is covered by two layers of revetment, hand laid stone revement placed next to the fill, overlaid with a reinforced-concrete lining. The bottom of this lining was protected by concrete walls carried down into rock along the edge of the channel. For 4,750 ft. the channel was excavated with a steam-operated dragline having a 90-ft. boom. In general the material was placed directly by the dragline into the levee but near the upper end some rehandling was required. Near the lower end the channel excavation was insufficient to make the levee and the material was hauled over standard gage track on top of the levee from points of excess excavation. The material was placed in 12-yd. dump cars by the dragline and hauled in trains by a small locomotive.

The northerly portion of the channel was excavated with a steam shovel, teams and wagons being used to place the material in the levees. The channel excavation was deficient to construct the levees so a considerable part of the levees was constructed with material obtained from borrow pits located on adjacent high ground. This borrow pit material was excavated by a steam shovel and hauled to the site with teams and wagons.

Driving the Tunnel

The concrete lined tunnel is of horseshoe shape, 28 ft. high and 28 ft. wide. It passes through several ledges of limestone and shale, the roof and invert both being in limestone. Changes in tunnel elevations from those originally contemplated were made to secure this re-



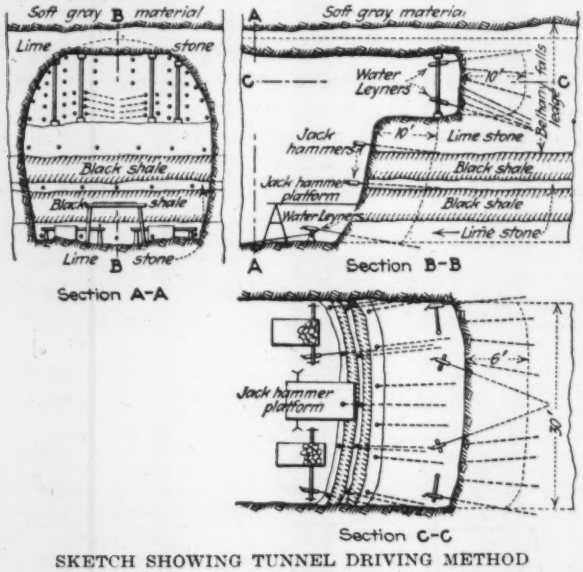
CONCRETE MIXING PLANT LAYOUT ON TURKEY CREEK TUNNEL

sult, thus avoiding the expense that a shale roof would entail. The roof was in a thick ledge of Bethany Falls limestone; the amount of rock cover near the upper end was small but deemed sufficient for the purpose as the rock appeared to be of excellent quality. The rock, however, proved to be very unreliable, especially after standing exposed for some time, and ultimately the upper 760 ft. of tunnel had to be timbered in some fashion to furnish support for the roof. To avoid similar difficulties on the lower end of the tunnel the grade for this portion was lowered some 3 ft. The lower end of the tunnel had been excavated at this time with the roof about 3 ft. low, it having been the intention to remove this section just prior to concreting the lining. To avoid disturbing this roof and at the same time to support it without going to the expense of timbering throughout, the grade was lowered 3 ft. and 20-ft. stretches of concrete lining immediately placed at intervals of about 100 ft. This expedient proved successful in stopping roof troubles.

Tunnel excavation was carried forward in two levels,

the upper level being carried about 12 ft. in advance of the lower, and both levels being advanced the same amount daily. A segmental section in the roof about 3 ft. deep was left in place to be removed just prior to concreting the lining. Excavation was handled in two shifts, the night shift doing the drilling and shooting and the day shift the mucking. An average night crew consisted of a tunnel drill foreman, seven water Leyner operators with one helper each; eight jackhammer operators with one helper each and two general assistants. The crew was practically on piecework and left when the usual 10 ft. had been drilled and blasted, varying in time from 6 to 14 hr. The following notes on this work are taken from the resident engineer's report:

A wedge-shaped set of eight holes was drilled with four holes on each side of the center line in a vertical row 8 ft. apart. The bottom hole, of the two rows, was placed about 1 ft. above the top of the bench and the remaining three holes were spaced on 1-ft. centers. The water Leyner machines, used exclusively in drilling these holes were set

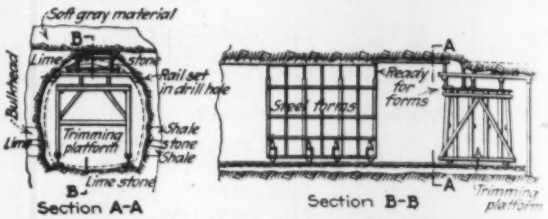


SKETCH SHOWING TUNNEL DRIVING METHOD

at such an angle horizontally that the holes when completed would just about meet at a point 12 ft. back from the face of the heading. Also a vertical dip was made in each set of the wedge holes, or as more properly termed, cut-holes, so that the bottom cut-holes would run down to a point approximately 18 in. below the level of the top of the bench or about 11½ ft. below the neat line of the tunnel roof at a distance of about 12 ft. back of the heading face. The remaining three cut-holes in each row were so drilled that each converged vertically to within about 6 in. of the outer end of each succeeding hole. This position of the cut-holes permitted the greatest effect from the blast as the inclined holes gave the powder a chance to lift the rock as well as to kick out the wedge-shaped piece of rock without serious vibration or shattering of the top of the bench or roof rock.

Owing to the nature of the limestone strata, the foreman had to exercise the very best of judgment in drilling the proper number of holes and locating the position of each, as there were a number of seams and shale pockets in the Bethany Falls ledge that proved detrimental to effective shooting if the proper precautions were not observed.

After completing the drilling and blasting for the cut-holes another series of holes was drilled semi-circling the location of the previous wedge or cut in such a manner as to break down the surrounding rock and gradually work out toward the excavation line desired. These rib-holes differed in number according to the nature of the rock formation, but they were usually placed in vertical rows at points 2, 6 and 8 ft. from the center line each way. The drills were so



METHOD OF TRIMMING AND SUPPORTING ROOF

directed that the holes gradually converged from the line of direction of the cut-holes to a line approximately parallel with the center line of the tunnel.

A set of easer-holes was next drilled between the rib-holes and the neat line of the tunnel section at a point 11 to 12 ft. each side of the center line and one each side of the center down 18 in. from the heading roof. These holes usually numbered five on each side and had a tendency to square up the heading previous to the final set of holes.

The last set of holes was spaced around the sides of the heading opening on the excavation line desired. Also two or four holes were drilled down 6 in. from the heading roof so as gently to break away the remaining rock in the tunnel arch without disturbing the roof of the heading. These finishing -holes were directed slightly outward during the course of the drilling so as to permit ease of operation of the drill. At the same time, the operator did not run any chances of losing the hole due to cramping.

Stope-holes were drilled horizontal to the tunnel section and 1 ft. above the bottom of this formation of rock. Underlying this top part of the bench rock there is a strip of bituminous (black) shale averaging 3.6 ft. in thickness. Next is a thin layer of limestone formation varying in thickness from 1.2 ft. to 1.5 ft. and into this rock were drilled five breast-holes through the center of the layer and horizontal to the tunnel section. Under this limestone there is a strata of blue shale varying from 3.8 ft. to 5 ft. thick. Below this shale formation there is another section of limestone in which the tunnel is seated and it is in this material that the finishing-holes for the bench were located. Usually five more holes were drilled within about 12 in. of the bottom of the tunnel floor.

The cut-holes are drilled first, then the rib-holes, easers and finishing holes for the roof and the sides of the heading, all by means of the water Leyner drills. The cut-holes were loaded with gelatin powder and discharged by means of an electric blasting machine and electric caps. The rib, easer and finishing-holes were loaded with the same kind of powder but were discharged with a time fuse. The stope-holes and the breast-holes were drilled with jackhammers and the finishing-holes in the bottom of the bench with water Leyners. All of these holes were loaded with the same kind of powder and discharged with electric caps and a battery. For a complete round of the blasting 400 lb. of powder was used daily, 80 lb. of which was 60 per cent and 320 lb. 40 per cent. About 28,000 tamping bags were used effectively. The shooting usually began between 1 and 2 a.m. and lasted until 4:30 to 5 a.m., so that everything was ready for the day shift to begin mucking.

The material was loaded into dump cars by a 40-ton shovel operated by compressed air and hauled out of the tunnel by cable by means of two hoists operated by air, one just outside the tunnel portal and one about ¼ mile farther up the channel. Suitable pieces were picked out to be crushed for concrete and the remainder used in building up levees and filling depressions adjacent to the levees. After the work was fully organized progress was exceptionally good, about 10 ft. per day being made regularly.

The tunnel lining in roof and sides was placed around collapsible steel forms although a short stretch near the upper portal and isolated 20-ft. strips were placed around timber forms. Concrete was mechanically mixed on the hill above the south portal, chuted down into the

tunnel into a pneumatic mixer and conveyed to place by compressed air through steel pipes.

The invert was placed last like a pavement after the remainder of the tunnel was completed and air had been removed. Materials were hauled into the tunnel and concrete mixed at the site.

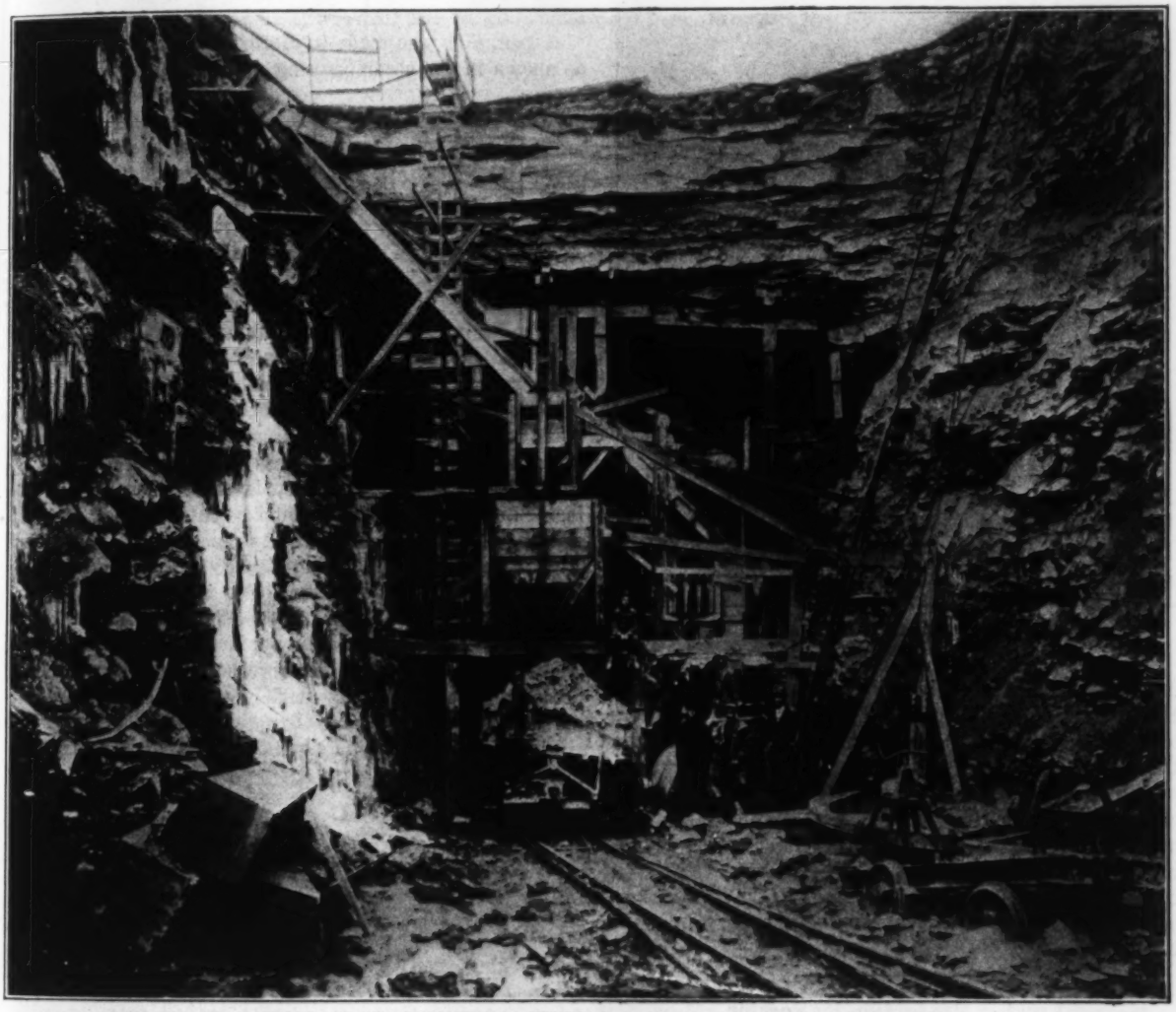
The subway consists of a reinforced-concrete box under the Santa Fe tracks. The tracks are carried on a heavy reinforced-concrete slab supported on sidewalls founded on rock and shale. A bottom slab is provided to care for earth thrusts on the outside of walls as well as to care for the Turkey Creek flow. This subway was put in without interruption of traffic, the tracks being temporarily supported on steel beams spanning the excavated area. The walls were placed in narrow sheeted trenches, which at the deepest point were 60 ft. below the tracks. After the wall trenches were excavated and the walls concreted, the top slabs were placed, the final operation being the removal of the excavation between the walls and the putting in of the floor of concrete.

The process of excavating for the subway and retaining walls was the same. The material was excavated by hand and shoveled into steel buckets which were removed from the excavation by stiff-leg derricks, and either dumped alongside the excavated hole or used in building up the Kaw River levees adjacent or in filling adjacent low ground.

An entrance into the Kaw River between the retaining walls was also dredged, this material being excavated with a clam-shell bucket operated from a barge, loaded onto another barge and dumped in the Missouri River.

Construction began in March, 1918. Trouble with floods in the tunnel resulting both from high water in the Kaw River and from high water in Turkey Creek due to rains over its watershed delayed the work considerably. A Turkey Creek flood in August, 1919, broke through the temporary dam protecting the tunnel at a very critical time in the work. The tunnel and outlet were so nearly completed that the concrete floor was about to be placed when the flood occurred. More than 7,000 cu.yd. of debris out of the temporary dam, out of the rock cut approaching the tunnel and from upstream was carried into the tunnel and deposited there intermingled with pumps, hoisting engines and all manner of equipment. In the face of all these difficulties the work was carried on energetically to completion and acceptance in November, 1920.

The Davidson Construction Co. of Kansas City, Mo., were the general contractors, but sublet the major portion of the work; the tunnel work to the Dock Con-



PORTAL OF TURKEY CREEK TUNNEL SHOWING SCALING ROCK LEDGE

tractor Co. (now Raymond Concrete Pile Co.), New York City, and the major part of the open channel work to Munn-Reise Construction Co. of Kansas City, Mo. William G. Thompson was general superintendent in charge for the Dock Contractor Co.

The contract between Kansas City, Mo., and Rosedale, Kan., placed the entire charge of the work in the hands of the latter, but outlined particular methods to be followed in administration and also appointed the

MOVABLE STEEL FORM FOR 28-FT. TUNNEL

necessary legal and engineering advisers. Harrington, Howard & Ash were employed as consulting engineers to prepare all plans and specifications and to supervise the work under the general direction of the city engineer of Rosedale. George R. Russell and Paul Hartung successively served in that capacity. Arthur E. Morgan of Dayton, Ohio, was subsequently employed to review the plans and specifications. For the consulting engineers Frank M. Cortelyou and Henry C. Tammen successively served as resident engineer supervising the construction.

Lumber Production by Species

From the U. S. Bureau of the Census lumber production by species as shown from 30,235 mills in 1919 as compared with the report from 46,584 mills in 1909 are as follows:

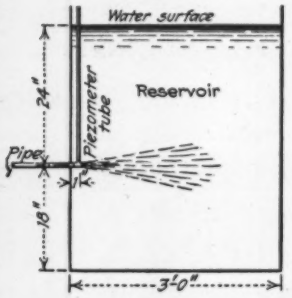
Kind of Wood	1919 Ft. B.M. (Billions)	Per Cent	1909 Ft.B.M. (Billions)	Per Cent
Yellow Pine	13.1	37.8	16.3	36.6
Douglas Fir	5.9	17.1	4.9	10.9
Oak	2.7	7.8	4.4	9.9
Western Yellow Pine	1.7	5.1	1.5	3.4
Hemlock	1.7	5.1	3.0	6.9
White Pine	1.7	5.0	3.9	8.8
Spruce	1.0	2.8	1.7	3.9
Maple	0.9	2.5	1.1	2.5
Red Gum	0.9	2.5	0.7	1.6
Cypress	0.7	1.9	1.0	2.1
Chestnut	0.5	1.6	0.7	1.5
Miscellaneous	3.8	10.8	5.3	11.9
Total	34.6	100.0	44.5	100.0

Loss of Head for Pipe Discharging Under Water Into Reservoir

BY C. O. WISLER
Associate Professor of Hydraulic Engineering, University of Michigan, Ann Arbor

FOR a pipe discharging under water into a reservoir there seems to be a common conception that the entire velocity head is lost at discharge. If this theory were correct the hydraulic gradient for the pipe line should slope down exactly to the water surface in the reservoir. That this is not the case is proved conclusively by recent experiments conducted in the hydraulic laboratory of the University of Michigan.

A ¾-in. pipe was made to discharge into the reservoir as shown in the accompanying figure. A ⅛-in. hole was drilled into the top of the pipe ¼ in. from the discharge end which projected about 1 in. into the tank. Care was taken to drill this hole normal to the axis of the pipe and to remove all burrs from the interior of the pipe so that the flow past the opening would be absolutely undisturbed. This hole was then connected with a ⅜-in. glass piezometer tube extending above the water surface. A small amount of colored oil was poured into the tube so that any difference in level between the liquid inside and outside the tube could be easily noted. Water was then discharged through the pipe into the reservoir with velocities ranging from slightly less than 7 ft. per sec. to about 16 ft. per sec. For these velocities the water level in the piezometer tube fell from about 1 in. to 5½ in. below the water surface in the reservoir. Higher velocities produced correspondingly greater depressions but it was impossible by the method used to measure velocities greater than 16 ft. per second.



Following are the tabulated results of the experiments:

(1) Number of Experiment,	(2) V Per Sec.	(3) Depression, Ft.	(4) $V^2 \div 2f$ Ft.	(5) Lost Head, Ft.	(6) L (See Text), Ft.
1	6.7	0.07	0.70	0.63	0.65
2	7.5	0.10	0.87	0.77	0.81
3	10.5	0.18	1.71	1.53	1.55
4	13.2	0.29	2.71	2.42	2.41
5	14.6	0.40	3.31	2.91	2.92
6	16.0	0.46	3.98	3.52	3.49

It is thus seen that for this range of velocities from 10 to 12 per cent of the velocity head is recovered. A curve of regained head plotted against velocity indicates that for higher velocities increasingly greater percentages are regained.

The practical significance of these results is that when a submerged pipe discharges into still water, as for example in the case of a water supply conduit connecting two reservoirs at different levels, the actual discharging capacity is somewhat greater than that obtained by computations based on the usual assumption that the hydraulic gradient drops only to the water surface in the lower reservoirs. This fact should be taken into consideration especially in connection with experiments to determine frictional losses in pipes since if it were neglected it is obvious that a set of values of "n" or "f" computed from experiments on relatively short pipes discharging under water would not agree with

results obtained from the same pipes discharging into the air.

These experiments controvert the commonly advanced theories which purport to show that the entire velocity head is lost at the outlet of a submerged pipe. These theories are set forth in various well known books on hydraulics and need not be repeated here. (Merriman's Hydraulics, p. 180; Hughes and Safford's Hydraulics, p. 294; Daugherty's Hydraulics, p. 100; et al.) The error in them arises from the assumption that a law of hydrostatics applies to a condition near the end of the pipe where the water is not at rest.

In 1911 and 1912 a series of experiments were conducted at the University of California by W. H. Archer to determine the losses that occur due to sudden enlargement in a pipe. (Trans. Am. Soc. C. E., Vol. 76, pp. 999-1026.) The velocities in the smaller pipe varied from 4 ft. to 32 ft. per sec. approximately, with a range in the diameter of pipes from 1 inch to 3 inches. As a result of these experiments Mr. Archer derived the formula, $h_L = 0.01705\ (V_1 - V_2)^{1.919}$. By letting $V_2 = 0$ this formula reduces to $h_L = 0.01705\ V^{1.919}$ which should give the loss upon discharge into a large reservoir. Substituting in this formula the experimental values of V shown in Column 2 of the accompanying table the resulting values of h_L are given in Column 6. Considering the fact that the formula was derived from the results of experiments on pipes having a maximum ratio of area of about 9 and is here applied to a case where this ratio is practically infinite the close agreement between the observed and computed values in Columns 5 and 6 is quite remarkable. The small differences are easily within the range of experimental error.

As a result of these experiments the writer believes that the formula proposed by Archer not only gives the correct loss that occurs in a pipe due to sudden enlargement but can also be properly applied to the extreme case of a pipe discharging into a reservoir. The writer would suggest that for practical use Archer's formulas might well be changed to $H_L = 0.017)\ V_1 - V_2)^{1.92}$ for finite enlargements of pipe and $H_L = 0.017\ V^{1.92}$ for discharge into a reservoir, since with this change the resulting error in H_L will always be but a small fraction of 1 per cent for velocities up to 100 ft. per second.

Cold Weather Records for Fourteen Decades

That there has been no permanent change in temperature since the Revolutionary War, so far as records kept in New Haven, Conn., are concerned, is the conclusion of Clarence J. Root, Meteorologist, U. S. Weather Bureau Office, Springfield, Ill., in a short article published in the *Monthly Weather Review* for January

For the 10 Years Ending	Mean Temperature, F°	For the 10 Years Ending	Mean Temperature, F°
1790	49.6	1860	48.9
1800	50.0	1870	49.1
1810	50.4	1880	49.7
1820	47.5	1890	48.9
1830	49.3	1900	49.7
1840	47.8	1910	49.7
1850	49.2	1920	50.5

(Weather Bureau, Washington, D. C.). Except for a few months in 1795, Mr. Root states that all available temperature records have been kept at New Haven since Feb., 1780. Up to 1872 the records were kept by various observers and since that date they have been kept by the U. S. Weather Bureau station at New Haven. Yearly averages in 10-year periods are given above.

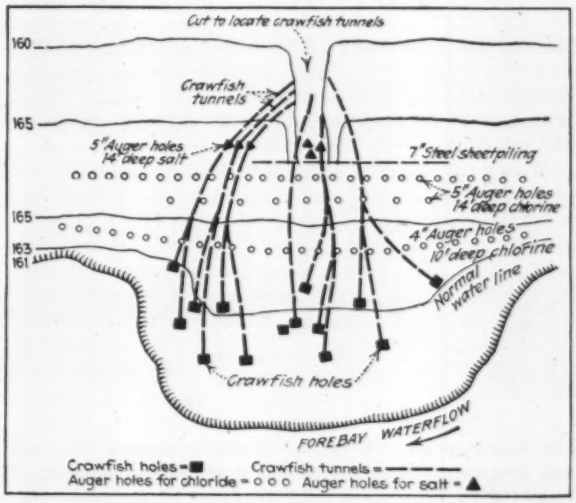
Elimination of Crawfish Borers in a Canal Bank

Soil Impregnated with Chloride of Lime by Light Dynamite Charge in Holes Intercepting the Crawfish Tunnels

By Frank M. Nash
Superintendent, Buckhorn Plant, Carolina Power & Light Co., Corinth, N. C.

SUCCESS in the extermination of crawfish in a canal bank has resulted from an experiment in impregnating the soil with chloride of lime and salt, thus solving the problem noted in *Engineering News-Record* of Aug. 19, 1920, p. 377. The embankment was built by the U. S. Government about 75 years ago and was acquired later by a local lighting company for use in a hydro-electric installation. It is parallel with and about 400 ft. from the Cape Fear River, and is about 7 ft. high with a top width of 10 ft.

A leak of 0.75 sec.-ft. or less had existed at one point for as far back as any records were available, and



CANAL BANK BORED FOR EXTERMINATING CRAWFISH

although the loss of the water was a small consideration there was danger of possible failure of the bank during high-water conditions. Crawfish holes under water on the canal side of the bank and the presence of large black crawfish in this particular section convicted the crawfish of causing the trouble. The crawfish tunnel openings on the forebay side (indicated by dots on the accompanying plan) have always been confined to a 30-ft. length of the bank and have seemed to converge in the one main outlet on the lower side of the bank.

At any time the leak could be checked and sometimes stopped entirely for a few days by lowering the water a few feet and puddling up the crawfish openings. Extensive earth filling in front of the leak would not stop it very long, as the crawfish would work through the fill. At some time in the past a row of 12-ft. tongued and grooved piling 2-in. thick was driven on the center of the bank, but this evidently secured only temporary results.

In October, 1920, a row of 12-ft. interlocking steel sheet piling was driven on the center line of the bank, directly in front of the leak outlet, for a length of 16 ft. (see plan). Each piece of piling was made up of

2- and 3-ft. lengths left over from another job and put together with iron plates and short bolts. This had no effect on the leak, but with the piling as a protection it was decided to explore the bank behind it. Beginning at the outlet of the leak, a trench was dug through the river side of the bank full 7 ft. deep, as shown. It was then found that some of the water was coming through the piling and some around it, but most of it was coming up from a deep hole that extended at least 2 ft. below the piling, or 14 ft. from the top of the bank. It then became evident that nothing short of a 50-ft. row of 20-ft. piling would cut off the leak. But at the same time it seemed reasonable to assume that if the crawfish would work down under the 12-ft. piling, they would also work under piling of a 20-ft. length.

A concrete mattress over the canal side of the infested section would not have prevented the pests from working around it. Methods used in exterminating crawfish on farmlands could not be used here, but on recommendation of the U. S. Biological Survey, it was decided to try impregnating the soil with enough chloride of lime to kill the fish. The difficulty lay in getting the lime down 16 ft. under ground and also in stopping the flow of water through the crawfish holes long enough for the lime to get in its work. To dig a trench 16 ft. deep and 40 or 50 ft. long was out of the question, so the following plan was carried out.

Water was lowered about 4 ft. in the forebay or until the leak stopped. With two post-hole augers (one 4-in. and one 5-in.) fitted with 16-ft. extension handles, 27 holes 14 ft. deep were sunk in front of the steel sheet piling, working from the center towards each end until no tunnels or soft places were encountered or until we got beyond the crawfish region. As each hole was sunk a quart of the lime was poured in and ½-stick of 40 per cent dynamite was fired by a 16-ft. electric fuse to scatter it and to intercept the tunnels. Each hole was then slowly filled and tamped with about 4 ft. of of dirt and another quart of lime and ½-stick of powder used in same way. A pint of lime was put in 5 ft. from the top and the hole tamped full of dirt. Thus the process consisted of laying a barrage of chloride of lime across the path of the crawfish, the charges being 2 ft. apart horizontally and about 4 ft. vertically and the earth being all packed and left free from tunnels across the barrage section.

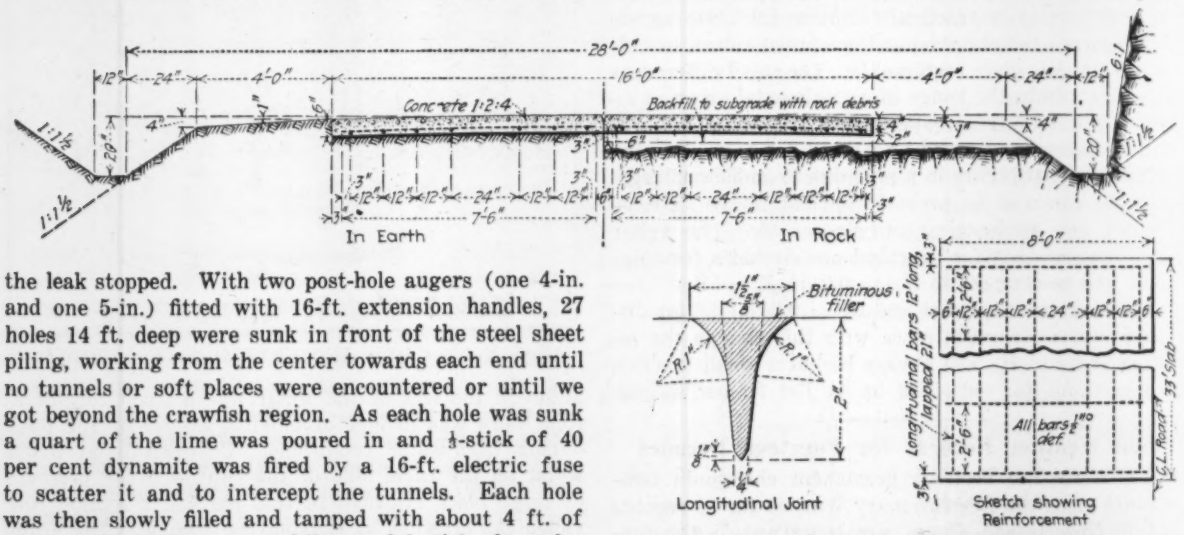
A second and shorter barrage was laid across the soft place some 3 ft. in front of the main barrage. A third barrage was laid in holes that normally were on the contour line of the water in the forebay. These holes were sunk only 8 to 10 ft. deep, as the former tests showed that the tunnels probably did not extend down more than 10 ft. so near the forebay. The lime was placed and scattered with dynamite in the same way. Water was encountered in all the holes in the infested area, but in most instances the digger worked right through, the soil being mostly of a heavy clay.

Finally, six holes were sunk directly into the main tunnels behind the steel piling, as indicated by triangles in the drawing; 50 lb. of common salt was put into each and the holes were tamped full of dirt. Then the experimental trench behind the steel piling was carefully tamped full of dirt and the embankment at this point brought up to grade. This work, done in November, 1920, stopped the leak and up to April, 1921, it had not reappeared. In the plan, the swing towards the forebay of contour lines 161 and 163 is due to some previous effort to stop the leak by filling in dirt.

The cost of the experiment was nominal. The 350-lb. drum of chloride of lime cost about $35 delivered; 50 sticks powder cost $4.50, and four days' labor for a crew of five men amounted to $65, or a total of approximately $100.

Concrete Roads with Longitudinal Plane of Weakness

A 16-ft. concrete pavement, with a plane of weakness at the center and each half-slab separately reinforced, as shown by the accompanying cross section, has been constructed this season on 4,910 ft. of highway in Madison County, New York. The section is indicative of a movement in the design practice of the New York State Highway department toward a double-slab pavement structure. The feeling is that a pavement slab built a half at a time or, with a defined construction joint at the center, if constructed full width, has structural and construction advantages.

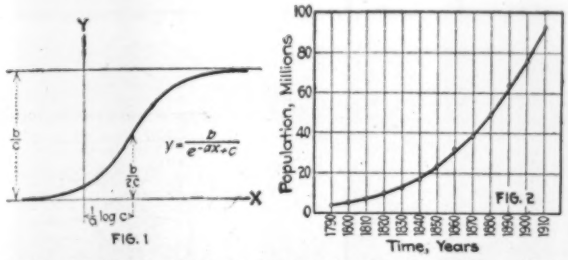


CONCRETE PAVEMENT WITH WEAKENED CENTER ZONE

In the slab section illustrated, a groove about one-third the depth of the slab is molded in the top along the center line and filled with bituminous filler. There is no reinforcement in the 6-in. center zone under this groove. A plane of weakness is thus established which it is expected will crack longitudinally and form virtually a two-slab pavement. The narrow slab structure is expected to have a decided tendency to reduce transverse cracking and to increase the durability of the pavement. L. D. Brownell, division engineer, is responsible for the design illustrated.

National Population Growth Expressed by a Semi-Rational Formula

IN A STUDY of formulas expressing the population growth in an integral country or nation, Raymond Pearl and Lowell J. Reed of Johns Hopkins University have recently developed an interesting formula, defining a curve of the type sketched in Fig. 1. Fitting the formula to population statistics of the United States and other countries showed a remarkable agreement with the facts. The development of the new equation is set forth in a paper, "On the Rate of Growth of the Population of the United States Since 1790 and Its Mathematical Representation," published in the Proceedings of the National Academy of Sciences, June, 1920, pp. 275-288.



FIGS. 1 AND 2. FORM OF EQUATION OF POPULATION GROWTH, AND APPLICATION TO UNITED STATES CENSUS FIGURES

Formulas previously proposed, generally of the exponential type, and a formula developed by the authors in which a logarithmic term was added to the exponential terms, have the peculiarity of indicating a continuous increase in population, regardless of the fact that the ability of a given geographical area to support population is limited. Thus, the equation of the type just mentioned, fitted to the population statistics of the United States from 1790 to 1920, would if extended to the year 3,000 give a value of 11,822,000,000 inhabitants, representing a population density of 6.2 persons per acre for the entire country.

The authors therefore adopted as a premise the condition that population has a maximum limit. Correspondingly they assumed that the rate of population increase at any particular time is proportional (1) to the total population at that time and (2) to the unutilized potentialities of population support existing within the area considered. Expressing these two assumptions in mathematical terms and integrating the rate of population increase, they obtained the formula

$$y = \frac{be^{ax}}{1 + ce^{ax}}$$

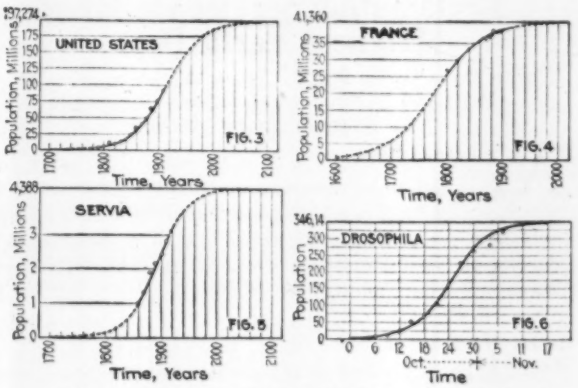
In Fig. 1, where this expression is plotted, the three constants are identified with particular dimensions of the curve.

In Fig. 2 this form of expression is fitted to the decennial population statistics of the United States from 1790 to 1910 by making it pass through the points for 1790, 1850, and 1910. The resulting formula, numerically, is

$$y = \frac{2{,}930.3009}{e^{-0.0313395x} + 0.014854}$$

which formula refers to an origin at the year 1780.

Using this formula, it is found that the upper limit of population, the upper asymptote in Fig. 1, has the value 197,274,000. It is also found that the point of inflection of the curve corresponds to April 1, 1914; in other words, at about 1914 the maximum rate of population increase in the United States had been reached, and the influences tending to retard population increase had begun to dominate over the stimulative ones.



FIGS. 3 TO 6. FOUR APPPLICATIONS OF THE POPULATION GROWTH CURVE

While the authors claim that they "attach no particular significance to the numerical results" of the calculation, they do feel sufficient confidence in the method developed to assert that they "believe that the period of most rapid population growth was passed somewhere in the last decade." They point out that the maximum population stated represents a density of 66 per square mile, which is only one-tenth that of Belgium, but they apparently attach no importance to this comparison.

However, in view of the possibility that national population growth will not show entire symmetry above the point of inflection, as does the curve of Fig. 1, they are seeking for an improvement of the formula given, by which such lack of symmetry may be taken into account.

In Fig. 3 are shown three other population plots, together with that of the United States shown on a smaller scale than Fig. 2. The plots for France and for Serbia are considerably less regular than those for the United States, but the curve represented by the equation above given (with numerical constants suitably adjusted, for the several cases) is applied as shown. The fourth plot in Fig. 3 represents the growth of a fruit-fly (*drosophila*) population in a half-pint milk bottle, which, the authors suggest, follows the same general law of growth proportional to population and to unutilized resources.

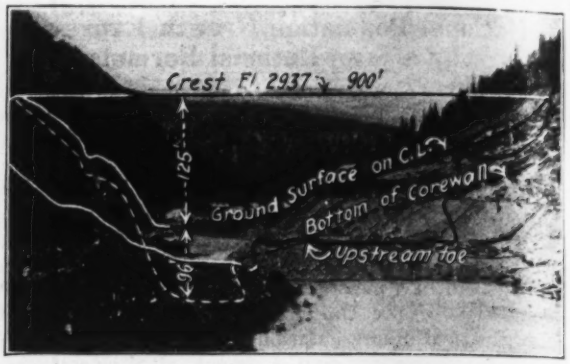
Qualifications of a Sewage Attendant

The most important detail in the application of chemicals and removal of sludge from the U. S. Naval Training Camp at Gulfport, Miss., was acquired when there was found and employed a negro who "hain't smelt nothin' for ten yeahs." He found it easiest to remove sludge by removing all clothing and getting down into the septic tank to do his shoveling. He was provided, says Lieut. Commander L. F. Bellinger in the November *Cornell Civil Engineer*, with a garden hose and nozzle for personal use.

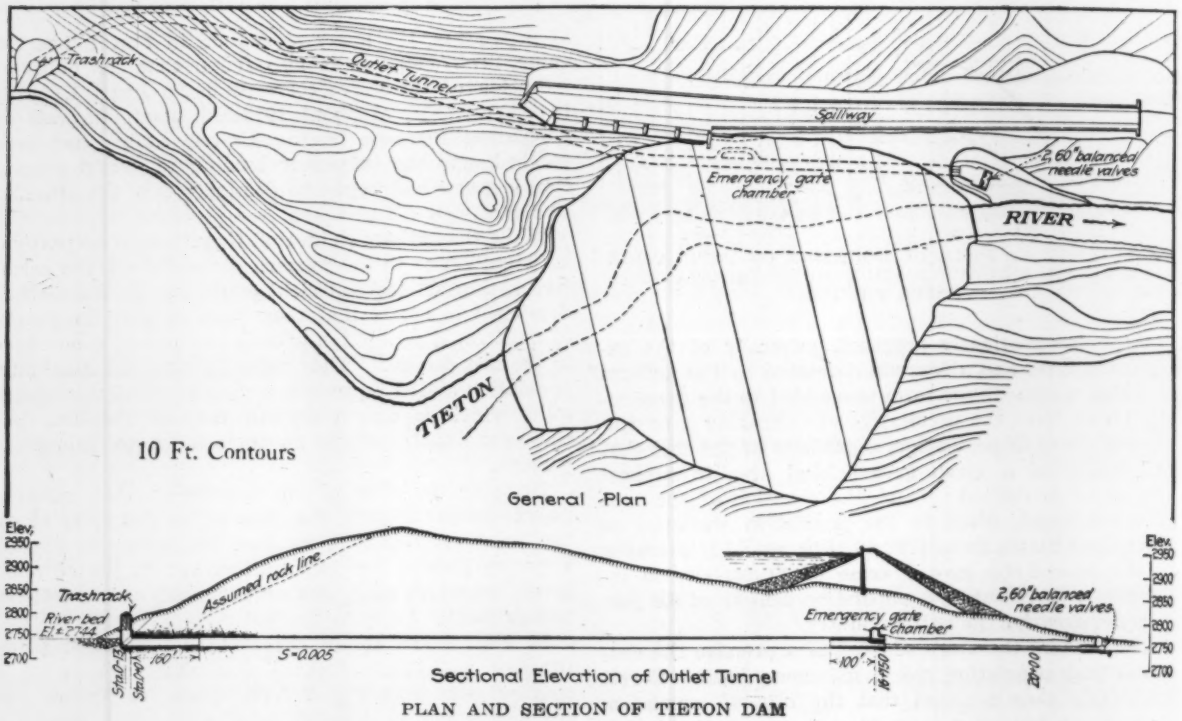
Reclamation Service Building Highest Earth Dam

Tieton Dam To Be 232 Ft. High With Concrete Core Wall 100 Ft. Into Rock—Core Wall Built by Extraordinary Method

AN EARTH fill dam 232 ft. high—only 8 ft. below the projected height of the ill fated Calaveras dam which would have been the record structure of this type—is now under construction by the U. S. Reclamation Service on the Tieton River about 26 miles above Naches, Wash., as a part of the Yakima Project. Not only is it a record structure but the core wall, a concrete barrier 5 ft. thick extending 100 ft. below the river bed, is being built by sinking shafts to the full depth, running a cross tunnel and extending the wall upward by stoping upward and concreting the successive lifts.



TIETON DAM SITE SHOWING PRESENT AND FUTURE CONDITIONS



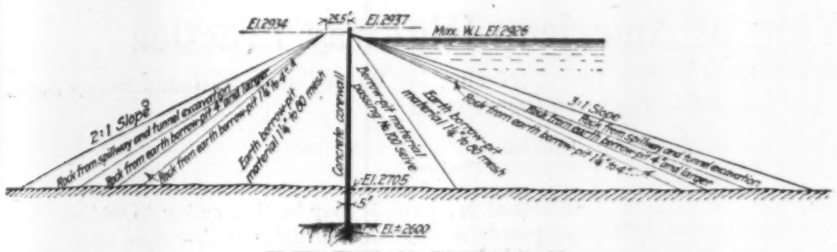
PLAN AND SECTION OF TIETON DAM

The Tieton Dam, as it is called, was started in 1917, but was closed down in 1918 on account of war conditions. Work has now been started again and will be carried through to completion. The dam consists of an earth embankment 232 ft. above the stream bed and 900 ft. long on top, heavily blanketed with rock as shown in the accompanying drawing, and with a concrete core wall approximately 330 ft. high. Its design and the present stage of construction was described as follows by F. T. Crowe, of the U. S. Reclamation Service, in the October *Reclamation Record*:

A diversion tunnel, 2,200 ft. long, is being excavated with a diameter of approximately 21 ft., which will carry the waters of the Tieton River during the construction of the dam and will be used as a portion of the outlet control system when the dam is completed. This tunnel is through a solid cliff of andesite rock, which is being drilled and shot by the top-heading and bench method, the muck being loaded into 4-yd. dump cars by a railroad type steam shovel remodeled with a short boom and A-frame and equipped with a 1-yd. bucket.

The corewall will consist of a concrete diaphragm completely crossing the canyon and tied well into bedrock on the base and sides. Below the ground surface it will be 5 ft. thick with no reinforcing. Above the ground surface it will taper to 1-ft. thickness at the top of the dam, be heavily reinforced and have no expansion joints. The excavation and placing of this corewall below the ground surface is one of the features of work being done during the present season. In the river bed it is necessary to excavate to a depth of 100 ft. to secure the proper foundation. The excavation tapers on the east side of the canyon to 35 ft. in depth, whereas on the west side of the canyon the bedrock is exposed and will require simply the cutting out of a key in the bedrock of about 5 ft. in depth.

The corewall base is being excavated by the stoping method. Three principal shafts are sunk to and into the bedrock. At the base of these shafts a large sump hole is constructed and pumps installed. Drifts 6 ft. high and 5 ft. wide are then driven in each direction along the line of the corewall and into the bedrock a depth of not less than 5 ft. and sometimes as high as 30 ft., depending upon the nature of the bedrock, so that the concrete will tie into good substantial foundation. After the lower drift is completed the second floor is excavated by dumping the material



ELEVATION OF TIETON DAM

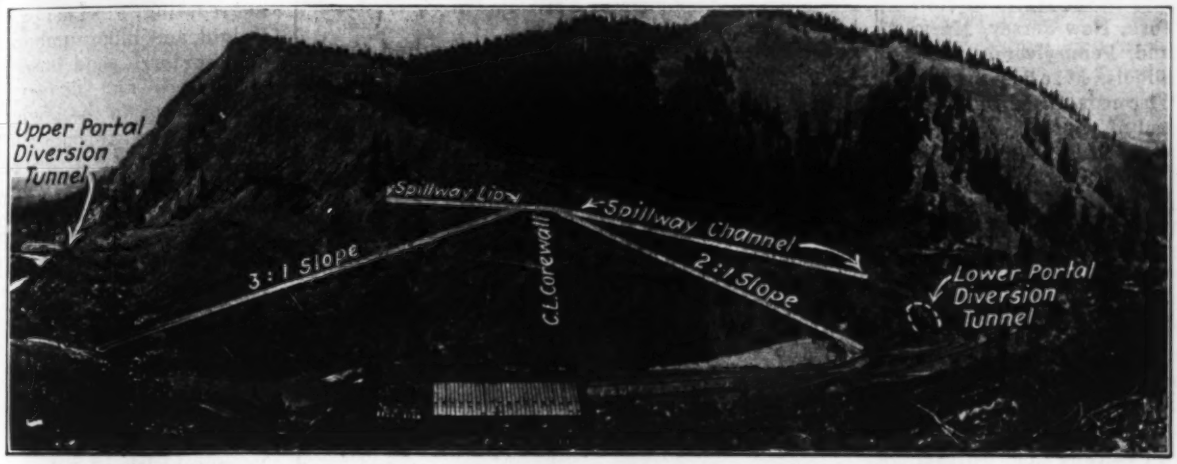
through the roof of the first floor into mining cars, which are run to the shafts, caged, brought to the surface and dumped. Thus the material above the lower drifts is never touched with a shovel. It is simply picked or shot down and trapped into the cars. After two floors have been excavated the lower floor is filled with concrete from cars running on the completed second floor. The third floor is then excavated, the second floor filled with concrete and a similar operation followed out until the ground surface is reached.

Considerable loose and swelling ground is being encountered, together with large quantities of water, making the work very difficult in the section immediately below the river. However, the method is working out very satisfactorily and is the only one thought practicable, considering the deep excavations required and the nature of the materials encountered, as it would be almost impossible to shore an open trench to such extreme depths.

The embankment will be a hydraulic fill blanketed with rock. It will have a 1 on 3 slope on the upstream side, 25-ft. top width, and a 1 on 2 slope on the downstream side. It is proposed to convey the material for the embankment to the outer slopes of the dam by cars from borrow pits (both above and below the dam) in which shovels will be operated. A 100-ton electric shovel on crawling treads is being purchased for operation in the borrow pit above the dam and a railroad type shovel operated by air will be used in the borrow pit below the dam. Eight 16-ton steam locomotives will be provided with 75, 4-yd., 36-in. gage dump cars. The tracks from these borrow pits will be brought to the slopes of the dam over trestles at intervals in elevation of about 30 ft. The material will be dumped from these trestles and washed by hydraulic giants to a center pool. This pool will be confined entirely to the section immediately above the corewall. The idea being to place all the tight material available above the core and have the core supported on the downstream side by heavy material that will drain out readily. From careful analysis of material available we find 20 per cent will pass the 80 mesh. This is very well graded to very fine clay. Fifty per cent passes the 1¼-in. screen and is held on the 80 mesh. Thirty per cent varies from 1¼ in. gravel to large rocks and boulders.

A spillway will be built in the rock cliff on the west side of the canyon. It will have an overflow lip 420 ft. long equipped with six drum gates of the Arrowrock type, 65 ft. long and 8 ft. high. The Spillway will have a capacity, under normal conditions, of 30,000 sec. ft. with a capacity of 50,000 sec. ft. before the dam would be overtopped. It will discharge through a concrete conduit down the side of the cliff to a pool well below the toe of the dam. The final design of the outlet control works of the dam has not been completed. It is proposed to have outlets to control the water at three stages so that the gates will never have to operate under a greater head than 80 ft. These outlets will each have a capacity of 2,500 sec. ft., the maximum irrigation demand.

It is estimated that the completed reservoir, including the roads, right-of-way and clearing will cost approximately $5,000,000 and will be completed in the fall of 1924. For this fiscal year $675,000 is available.



WEST ABUTMENT SHOWING DIVERSION TUNNEL AND SPILLWAY LOCATIONS

Electric power for the construction of Tieton Dam is supplied from a hydro-electric plant located three-fourths miles downstream from the dam site. Water is supplied to the plant by means of a wooden flume 8 ft. wide and 6 ft. deep, diverting from the river just below the dam site and running along the river bank for a distance of 4,400 ft. to a forebay and spillway also of timber construction. From the forebay water is supplied to the turbines through two penstocks each 250 ft. long. The penstocks are wood stave pipes 48 in. in diameter supported on timber saddles above ground. Stave timber is untreated douglas fir. Two hundred second-feet of water is supplied to the turbines at a working head of 75 ft.

The work is under the general supervision of the U. S. Reclamation Service of which A. P. Davis is director and F. E. Weymouth is chief engineer. F. T. Crowe is construction engineer in local charge of the job.

Philadelphia Municipal Bonds Bring Premium

The highest all-or-none bid for about $12,660,000 of Philadelphia 5¼ per cent municipal bonds on Oct. 28 was at a premium of 3.399 per cent, from a syndicate headed by the National City Co., New York City. Two other all-or-none bids were at premiums of 2.7312 and 2.58. In all there were about fifty bids, for varying amounts, totaling $40,000,000. Of the $12,660,000 of bonds offered, about two-thirds will run from 20 to 50 years and one-third for 15 years.

A British View of American Highway Practice

Our Vehicle Weights Regarded as Light—Bituminous Surfacing for Worn Concrete Roads Suggested—Highway Research Commended

BY A. DRYLAND
County Engineer of Middlesex, England

To the Editor of "Engineering News-Record":

SIR—When I was with you in New York in September I promised to give you some account of my impressions of American roads and cognate subjects, but since my return I have been hard pressed with official work and demands from English papers to which I was previously committed, and have not found a favorable opportunity to write to you.

Thanks to your kind assistance in arranging and facilitating my tour I was able to spend a most interesting and instructive 25 days in the states of New York, New Jersey, Maryland, Pennsylvania, Ohio, Illinois, Michigan and Wisconsin. I saw a great deal of your fine cities of New York, Washington, Harrisburg, Cleveland, Detroit, Chicago, Springfield, Ill., and Milwaukee, which I made my resting places, but not nearly so much as I should have liked had time permitted. I spent altogether 33 days in Canada and in the States, during which period I traveled some 4,500 miles by railroad and 2,500 by road. I feel that I am entitled to say that I "sampled" your Eastern states, although I fully realize that with so vast an area it is only possible to "sample," but as I was on the roads practically all of each day, doing my railway journeys mostly by night, I made the best possible use of my available time.

Many American highway engineers had the pleasure of meeting Mr. Dryland during his month's inspection of road-building methods in this country last summer. Before returning to England he was induced by the Editor of "Engineering News-Record" to record his impressions of our practice; his views are set forth in the highly interesting notes published herewith.

Coming from a veteran of 40 years' experience in the road-building field in England, and a past-president of the County Surveyors Society, Mr. Dryland's appraisal of some of the features of the work he saw in the United States is entitled to great weight. Readers of this article will find it worth while to refer to the biographical sketch of Mr. Dryland, which appeared in the Sept. 8th issue of this journal, p. 423.—*Editor.*

When one has seen so much that is interesting and new it is difficult to crystallize, but as you desired that I would be frank in recording my impressions, and free in offering criticisms I will endeavor to do so under the following heads:

Traffic—The large number of motor vehicles to be seen in and around your cities was very striking and far exceeded numerically anything we have here. The great difference between your traffic and ours is in heavy motors, of which you have comparatively few. In Britain the number of "heavy" motor cars registered (i.e., cars weighing more than 4,480 lb. unladen) is almost exactly identical with those registered as "light" motor cars, which include motor cycles, of which latter there is a large proportion. As most of the heavies will be in daily use for business purposes while the light cars and cycles are often only in use at weekends, it is common to see more heavy than light vehicles on our roads. Some of your road engineers seemed to think they had large numbers of the heavy type to contend with, but I had to tell them their troubles were only beginning and were comparatively unappreciable at present. It may be that owing to wider spread of population and larger distances between urban areas this kind of traffic will not develop to the same extent as with us; if it does, your roadmakers are up against a much more serious problem than they have yet had to face.

We have a good many traction engines drawing three trailers constituting a gross loaded weight sometimes of as much as 55 tons, also steam tractors drawing one steel-wheeled truck, gross weight 15 tons, many steam wagons drawing trailers aggregating a similar weight, and huge numbers of motor lorries and buses, charabancs and delivery vans linking up the towns and villages throughout the country, substituting road for rail delivery of all kinds of goods except for long journeys.

Another feature which impressed me was the superior tire equipment of many of your motors by means of the giant pneumatic which has so far, I regret to say, hardly put in an appearance here. Your vehicles in every class are of lighter construction than ours, a very favorable feature from the roadmaker's point of view. Bearing all these differences in mind I came to the conclusion that in the nature of traffic your road engineers' lot is an enviable one.

Perhaps I might be permitted to say a word here on traffic regulation. On your country roads your vehicles keep their proper sides far better than with us, where the driver of the heavy vehicle is much inclined to take the center of the road if he can, and keep it, being resolutely deaf to the hootings of speedier cars desiring to pass. In your cities, as with us, the street railways contribute largely to congestion of traffic by a practical monopoly of so large a proportion of the width. Your regulation that no other vehicle shall pass a standing street car appeared to me to exaggerate the obstruction. Here we have no such regulation, and motor drivers carefully thread their way when cars are being discharged and so often avoid a stop. I believe the accidents from this practice are extremely few, as car passengers keep a good lookout and regulate their escape to the footway accordingly.

Highway Development—In this country roads were the means of communication for at least a century before railways were thought of and naturally there is a great difference on your side where the railway largely preceded development. Here a complete network of more or less heavily metalled highways permeated to

every part of the country, and practically every rural highway for nearly a century has been surfaced with macadam, and probably for the last 30 years has been steam-rolled. When I penetrated your rural areas and found many highways with only mother earth to carry the traffic the difference was naturally striking. Here we have a primary monetary advantage in having a foundation which we can strengthen and build upon at comparatively small cost; on the other hand your side has the opportunity of putting in a more perfect foundation designed with a fuller knowledge of probable future requirements.

"Some of your road engineers seemed to think that they had large numbers of the heavy type [of motor vehicles] to contend with, but I had to tell them their troubles were only beginning."

Concrete Roads—The circumstances referred to in the paragraph above account very largely for the development of this form of construction on your continent. If we today were constructing a new road to carry heavy modern traffic the first consideration would be a firm foundation, and concrete would seem to offer the best solution. That is the line I have myself taken in the construction of new arterial roads passing through the County of Middlesex to the boundaries of the County of London, and, following your practice, I propose to utilize that foundation to carry the traffic so long as it will do so without serious detriment to its use as an ultimate foundation.

That is my view of the probable evolution of the concrete road in this country for the kind of traffic to which I have alluded. It is, I know, contrary to the view held by many of your eminent highway engineers, but not by all. You have out-and-out advocates of the concrete surfaced road as *the* solution of the highway problem, and if your traffic continued to be of the same weight and character as rules today, they may be justified. I saw many hundreds of miles of concrete surfaced road of varying ages in the States rendering admirable service and giving promise of several years further durability. I saw also some earlier constructed lengths which gave evidence of having nearly reached the end of their tether as a surface. Where that is the case I think your problem is to decide whether you will reface with concrete or adopt something of a more resilient character. My own view is that you will eventually find it desirable to take the latter course. In saying that I do not question the wisdom or economy of the course your engineers have pursued in adopting concrete in the first instance; on the contrary, I think they have been absolutely right in doing so. I sincerely hope the out-and-out concrete men will prove right and that concrete surfaces will meet your requirements for an indefinite period, but frankly, "I ha'e ma doubts," as my Scotch friends would say.

In the case of old concrete roads requiring repairs Mr. Dryland says: "Your problem is to decide whether you will reface with concrete or adopt something of a more resilient character. My own view is that you will eventually find it desirable to take the latter course."

The carefulness with which your road engineers deal with concrete road construction, and the organization for speed of laying are, I think, admirable. I found the concrete roads most excellent for speedy travel and to me their general appearance was pleasing, although marred by the unsightliness of joints and cracks which, however, where kept filled, did not affect smooth travel or lead to any serious deterioration. I gave a great deal of attention to the phenomena of cracks, and came to the conclusion that they were almost entirely due to physical causes, such as subsidence or upheaval of subsoil and effects of temperature changes, which are very extensive on your side of the water compared with those experienced here. The investigations your engineers have made into shrinkage and swelling of subsoils due to variations of moisture content are most valuable, and the data already obtained are, I think, quite sufficient to warrant my conclusion that the defects found in concrete roads arise almost entirely from elemental forces. Those which do arise from traffic are being provided against in the later methods of construction by greater thickness of concrete or by steel reinforcement.

City Pavements—In this country Baltic or Swedish fir is our favorite and most general "big city" pavement, with granite setts a bad second and asphalt third. Judging by what I saw of your big cities the positions there are exactly reversed, asphalt being largely in the ascendent as a city pavement, and generally, I thought, it was excellent and more free from waves or ripples than ours, notwithstanding your greater range of temperatures. Probably the comparative lightness of your traffic units and the greater resiliency of your tires, accounts in a large measure for this lesser amount of distortion. I also think your asphalt is "harder" than ours, which accounts for the cracks you have, a feature almost unknown here, but the less plastic nature of your mixtures renders it less liable to surface distortion. There must be a happy medium which will neither crack nor push, and I know many of your asphalt experts are experimenting in that direction.

I saw a great deal of stone-filled asphalt pavements both in cities and in their environs, much of it excellent, but some a good deal distorted. On similar roads in this country we have used tar macadam with great success, using mainly as aggregate blast-furnace slag. Here we have had a large, although insufficient, supply of excellent slag; but possibly your blasting processes do not produce slag of the same excellence, for what I saw was light and much honeycombed.

Brick pavements, I observed, are much used in the environs of large cities and in the smaller urban areas, and struck me as having a pleasing appearance and affording quite good traveling surfaces. But where a brick pavement was cement-grouted, and thus rendered practically monolithic, it was subject to a good deal of cracking due to elemental forces and leading to unsightliness and deterioration. An elastic joint filler would, I think, be a great advantage.

Road Engineers—I left your country with a large measure of admiration for the men in all ranks to whom you have entrusted your great task of providing a complete system of good highways for your huge country. Your system of training is quite different to ours and I think has great advantages, although we do manage to evolve a quite useful type by our more haphazard

methods. Here our youths serve a period of pupilage, generally of three years' duration, with a practicing engineer, after which they graduate by a series of assistantships and eventually compete, after experience has been so gained, for chief appointments. Most of them study for and pass examinations held by our Institution of Civil Engineers, or the Institution of Municipal and County Engineers, or both. Some few take a course of general engineering at our universities, but this is a comparatively modern development, and so far, unfortunately, we have no chair of highway engineering at any of our universities. While the practical training and experience they gain in our method is valuable, I and many other English engineers think it would be of great advantage in mastering more thoroughly the theory, at any rate, of the profession, if our men had opportunities of university education such as yours enjoy.

I had the privilege of meeting a great number of your engineers and was greatly impressed by the thoroughness and attention to detail they gave to both the theoretical and practical side of their work, while their organization for supervision and testing was of the most complete character. I envied your state bureaus for testing and investigation, a most necessary and desirable feature of organization which is almost entirely neglected in this country, where it is most difficult to convince the public of the value of scientific investigation and research.

While it is almost invidious to particularize, having experienced such universal kindness, hospitality, and assistance, from everybody in Canada and the United States connected with highway administration, I would like the privilege of your columns to publicly acknowledge and thank them. I had the pleasure and advantage of conferring with the engineers of the Federal Government of the United States and of the state administrators and engineers of New York, New Jersey, Maryland, Pennsylvania, Ohio, Michigan, Illinois and Wisconsin, the engineers of Baltimore, Washington and Chicago, the professors of highway engineering at Maryland and Michigan Universities, and the engineers of the Dominion of Canada, and of the Province of Ontario, and the city engineer of Montreal. Many engineers connected with portland cement and asphalt associations were also of great assistance to me in my investigations. From every source, public and private, information and help was ungrudgingly afforded in the kindest and most complete manner and I owe one and all, both chiefs and staff, a debt of gratitude.

Last, but by no means, least, am I indebted to you for all the trouble you took to render my visit informative and pleasant, in which your Chicago colleague also rendered most valuable assistance. It was my first trip to the Western Continent; it has been a most pleasant and educative experience from beginning to end, and I shall always look back upon it with pleasure, not only for the privilege of viewing the splendid way in which your engineers appear to have tackled the great problems so large and varied a country offers for solution, but with deep gratitude for the universal kindness with which I was received and entertained wherever it was my good fortune to travel.

New Chicago Union Station Center of Attractive Group

Architectural Treatment of Station with Office Building Above—Concourse Separates Two Stub Track Terminals

CHICAGO's great union station as it will appear when completed, together with its immediate surroundings, is shown by the accompanying reproduction of a drawing prepared by the architects. Work on various parts of the project, including extensive street alterations and viaduct approaches to the river bridges, has been in progress for the past few years, but the headhouse and station proper have not yet been built. The station is of twin or double-end design, with a transverse concourse between two sets of stub tracks for the railways entering from the north and south respectively, with common facilities for handling passengers and baggage.

CHICAGO NEW UNION STATION AND ITS SURROUNDINGS AS SHOWN IN THE ARCHITECTS' PERSPECTIVE

At the left is shown the new headhouse, occupying an entire city block and surmounted by a 20-story office building in order to utilize the air rights for revenue purposes and thus assist in financing the project. This is a revision of the original design, which provided a relatively low building for railway purposes exclusively. In front of the headhouse are the roof and entrances of the transverse concourse, with a river front street on an arcaded portion of the station. In the two blocks north of the station (to the right in the sketch) is the low roof of the trainshed. Behind this is shown the proposed new U. S. Post Office and Federal Building, two blocks in length. This structure has been designed and located as part of the Chicago City Plan, but it has not yet been approved by the Federal Government. Further to the north is the passenger terminal station of the Chicago & Northwestern Ry., which has been in service for some years.

Station Facilities

South of the concourse will be another low-roof trainshed. Beyond this will be the U. S. Railway Mail Terminal, which is now under construction. Other new railway structures in the vicinity are the freight station and office building of the Chicago & Alton Ry. (*Engineering News-Record*, Oct. 14, 1920, pp. 728 and 732), the freight station and warehouse built by the Pennsylvania R.R. a few years ago, and the freight station of the Chicago, Burlington & Quincy R.R., of which the foundations have been built.

At the new union station and its approaches the tracks have been depressed to about 4 ft. above water level in the river, and streets have been raised and widened to provide adequate approaches. In the south trainshed will be 14 tracks and in the north trainshed 10 tracks, all arranged singly and separated by platforms, alternate platforms being assigned for handling baggage and being connected by inclines with the baggage room under the concourse. A trainshed approximately 25 ft. high will cover the tracks and platforms.

In the headhouse, connected with the station proper by passages beneath Canal St., will be such main facilities as the waiting room, ticket offices, baggage rooms, restaurants and cabstand. Carriages and cars will use inclines from the Clinton St. entrances to the cabstand at track or concourse level. Baggage wagons will use the same entrances and driveways but will proceed by a second incline to a yard about 400 ft. long serving the large baggage room under the concourse. The exterior of the headhouse, office building and concourse entrances will be of buff stone.

This great station, which will supersede the present old and inadequate Union Station, is being built by the Chicago Union Station Co. of which J. D'Esposito is chief engineer and A. J. Hammond is assistant chief engineer. The architects are Graham, Anderson, Probst & White, of Chicago.

Laboratory Car For Brick Kiln Tests

Arrangements have been made, in connection with the co-operative agreement between the associations of brick manufacturrs and the Bureau of Mines, to fit up a laboratory car which will be used in testing kilns at brick works. This will make possible a more expeditious handling of this phase of the work and will permit its being done in a thorough manner.

National Help Only to Ports Encouraging American Ships

IN a paper entitled "The Importance of Port Facilities in the Development of a Merchant Marine and Commerce," read before the recent meeting of the Society of Naval Architects and Marine Engineers, Rear-Admiral H. H. Rousseau, Civil Engineer Corps, U. S. Navy, advocated national aid only to such ports as encourage American ships. Among other things he said: "With the existing fierce competition between ports, both for business and for appropriations from the national treasury for the further improvement thereof, it would seem to be proper and consistent that Congress should now give definite notice that hereafter preference will be given in making any appropriations for harbor improvements to those ports that show themselves most interested and most successful in carrying out our national policy that the greater part of our foreign commerce shall be carried in American vessels. Compliance with any such policy by a port, or the giving of satisfactory guarantees to fulfill any conditions like this, could be best undertaken by an organized and unified port authority, and the matter of efficient organization is perhaps our ports' greatest need today. . . . Such an act of Congress relative to water terminals and vesting the Secretary of War with discretion to delay or suspend expenditures for the improvement of any port unless at least 50 per cent of the gross tonnage of vessels engaged in foreign commerce entering and clearing from that port is American tonnage, or until satisfactory assurances are received that that percentage will be secured within a reasonable time and will be thereafter maintained, would instantly broaden competition between our ports beyond the present mere unorganized scramble for business on the part of individual carriers and other interests, and would initiate a competition that would bring concrete results in promoting steps to obtain a unified port authority and in assisting our merchant marine to get much needed cargo, as well as passenger business, that at present is going to foreign vessels. . . Should Congress also direct the Interstate Commerce Commission to exercise its rate-making power so as to give due preference and assistance to those ports where at least 50 per cent of the gross tonnage of vessels engaged in foreign commerce, using that port, is American tonnage, the effect would be striking in enabling our merchant vessels to cope more successfully with foreign competition."

Wisconsin Builds 2,552 Miles Road in 1921

Construction of roads of all kinds in Wisconsin this season will surpass in mileage any previous year. According to the quarterly report of A. R. Hirst, state highway engineer, 90 per cent of the 349.25 miles of concrete planned was completed by Oct. 1 and practically all of the remaining mileage will be completed this fall. Of the total mileage 105 miles only was Federal Aid. Other types of road constructed are as follows: Gravel, 1,036.9 miles; top soil, 84 miles; earth, 1,009.6 miles; bituminous, macadam, shade and asphalt, 72 miles. By gang maintenance 949 miles were graded; 129 miles, graded and graveled; 115 miles, resurfaced only and 11 miles covered with top soil only. A condition survey of the entire trunk highway system has been undertaken, giving the type and condition of the surfacing as of Nov. 1.

An American Engineer's Impressions of Industrial Russia

Intensive Nationalization Coupled with Greed and Executive Impotence Has Destroyed Economic Stability —Industry Ruined by Lack of Production and Misdirected Effort

By Royal R. Keely,
Consulting Management Engineer, New York City

MANY reports concerning chaotic conditions in all industry, and of the failure of Sovietism as there applied, have come out of Russia. Some of them have been based upon fragmentary knowledge and others doubtless have been intentionally prejudicial. However, the opinion is generally held that Russia today is in the worst condition economically and industrially. This opinion is confirmed by the following article by Mr. Keely.

Mr. Keely is a graduate of Cornell University and a member of the American Society of Mechanical Engineers. He has been professor of engineering, served four years with the Westinghouse companies, was four years manager of the Edmonton, Alta., Can., Municipal Industries—designing, building and operating—and for the past ten years has been a consultant in industrial economics, organization and management. Desirous of studying industrial conditions in Russia, Mr. Keely went there in 1919. A year later he was thrown into prison when he was about to return to America, and was released after a year's confinement upon the demand of the American Relief Association.—Editor.

AS a consultant in industrial economics in America my chief interest has been the labor problem. I had long wished to see how labor acted under Bolshevism, to study Russian industrial conditions and to appraise the prospect of resumption in trade relations between this country and Russia. Accordingly I sought out Lomonosoff, a special commissioner of the Soviet government in the United States, and my suggestion that I visit Russia was welcomed enthusiastically. We sailed from New York May 24, 1919, and after many difficulties and delays crossed the border and into Russia Sept. 12 of the same year, arriving in Moscow six days later.

Entertained Then Imprisoned

For eight months I was given every opportunity to travel about and to study the industrial and economic situation. As long as the Bolsheviki thought there was a possibility of my becoming permanently enlisted in their cause everything that this poverty-striken country could provide was lavished upon me—secretaries, a special car on the railway, the finest hotel accommodations, and food from the Kremil, the stronghold of the Bolsheviki. After having studied conditions in many regions, and after having had numerous interviews with Lenin and other high officers of Soviet Russia, I decided to return to America. Therefore, by May, 1920, all permits and documents had been signed, countersigned and red stamped, and I left Moscow. On May 12 at the border in Yambourg I was seized, five minutes before the train was ready to cross the border, and taken back to Moscow under armed guard and thrown into the Bouterki prison—the Sing Sing of Russia. No official warrant for my arrest was presented nor were there any explanations, charges, hearing, trial, or sentence.

After suffering for a year all the insults and deprivations which they could inflict I was brought with much solemnity into their highest tribunal, and after a few days was sentenced to two years in a concentration camp, sentence dating from the day of arrest. Evidence against me was produced from letters and memoranda written to my relatives in New York. Thus the action of the Bolsheviki in throwing one about to leave the country into prison characterizes the desire of Bolshevik Russia to keep from the rest of the world news of the abject failure of Soviet principles as applied there.

In my sentence I was said to be a spy, that I had collected news of the economic and industrial situation for the American capitalistic press, and that therefore I should be sentenced to two years in prison. A few days later after another solemn court procedure my sentence was changed to two years of compulsory work. That was on May 24, 1921, exactly two years after my departure from New York. Before my compulsory work began there came an order for my freedom and permit to leave Russia due to the demands of the American Relief Association.

General Impressions

My general impressions of Russia are that (1) it is inhumanly autocratic; (2) that the attempted nationalization of all activities has resulted in the operation of industry—an operation which has steadily diminished—for the benefit of a very few; (3) that nationalization of industry as applied there has been a dismal failure; (4) and that there appears to be in Russia a general belief that Sovietism cannot long survive.

No monarchy was more autocratic than is Soviet Russia. On entering the country one of the first things to attract my attention was the censorship. The government receives in its own hands all foreign news as well as that of local and internal affairs. There is no free press and the Bolsheviki give out such matter as they choose through their two dailies. Most of the leading papers from other nations are received in the foreign office, but they are not for the general public. Of late this censorship has broken down to some extent because of foreign commissions which have uncensored mail privileges and through courier service. The entrance of the American Relief Association has also opened the way for more freedom in communication.

Few in the outside world can realize that in Russia today there is a more strict and destructive autocratic power than has ever existed. Freedom of speech is unknown. Freedom of the press is a joke. Let me quote Lenin's own words, "We have arrived at autocracy and the object of the Communist International is a struggle with force of arms for the suppression of the international bourgeoise and creation of an international Soviet republic as a transition stage for the complete depression of the state. The victory is incomplete until every part of Europe is revolutionized. In the autocracy of the chiefs of communism and the communist domination of the people lies the pledge of our success. There can be no liberty or democracy, but there must be submission to the armed vanguard of the proletariat."

I had several conversations with Lenin. When I first arrived in Moscow Lomonosoff took me to see him. In order to enter the Kremil and Lenin's private sanctum we required special passes which were carefully scrutinized by some ten or fifteen armed guards at various stages of our path of entrance. His outer office was filled with stenographers and clerks and his own office was a large, well-lighted room on the top floor of a six-story building. It was finely furnished and much like an American business man's office. Lenin impressed me as an impractical idealist,

who was to a large extent shut off from the work of the world, and the difficulties and privations of his people, and who had little experience or ability in directing the organization and reconstruction of such a great nation. He was surrounded by men, who, like himself, perhaps, may have been revolutionists, but who had no executive ability for directing the enormous task which they had taken upon themselves.

Lenin repeated to me the invitation of Lomonosoff that I go into all the factories and see the actual conditions and study the psychology of the working force. In return for this freedom he asked me to give him reports on anything I saw which was not in accordance with American practice.

Other Prominent Soviet Leaders

Trotsky, the other leader of the cause of freedom and liberty for the worker says: "All artisans will be sent into the world and transferred from one place to another according to the indications of the government. We will have no pity for the peasants; we will make labor armies of them, with military discipline and communists as their labor chiefs. The masses of the workmen should be moved about, ordered and sent from place to place in exactly the same manner as soldiers."

The most competent two men among all the high government officials are Krassin, formerly head of the Railway Department and now head of the Department of Foreign Trade, and Ludwig C. A. K. Martens, both said to be Germans, of German origin, German tendencies and German sympathies. Martens was formerly an envoy of the Soviet government in the United States but was deported last year. Before going to Russia Martens, then in New York, had approved Lomonosoff's invitation to me to visit Russia.

The autocracy of Bolshevism is further evidenced by a description of the Soviet government operation. Everything is in the hands of the government, including the entire means of production and ways of communication. It controls all ammunition and arms and enough communist officers to control the soldiers. The agents of Bolshevism enter all buildings at will. They censor the mail and allow no private telegrams. They own the press and publish only what is good propaganda. No private meetings are allowed. All other political parties are suppressed with an iron hand, the leaders are imprisoned and the members scattered and cut off from communication with one another. The All-Russian Commission for the Suppression of Counter Revolution is a great octopus drunk with its power, always robbing, imprisoning and murdering those who oppose its will.

In Russia people are loaded down with documents—an official passport, a compulsory labor book, permits for food and food cards, permits for a place to live, permits to ride on the street car (one to say you are permitted to ride and a second to say you are the person named in the first.) If a trip on a railroad is contemplated five or six or seven documents are required, signed, countersigned, and red stamped, which require from one to two weeks to secure.

Lists are constantly being circulated demanding the full history of each individual. In reply to the question as to political affiliation the usual reply is "non-partisan," for if a signified allegiance to any other party is noted it would lead to persecution and possibly to imprisonment.

The prisons are filled with those who have asserted themselves or in some manner expressed their individuality. They come from all over Russia and the personnel is constantly changing. The foreigners, however, have it far easier than the average Russian, for few of them have been shot while the native is in constant danger.

One of the few things in which Bolshevism has proven successful is that it has destroyed all opposition to its operation.

Despite the fact that Soviet Russia is presumed to be a community wherein equality of interests obtains, the government as operated is decidedly for the benefit of the few.

The central Moscow government has some twenty departments, including the departments of war, state, national economy, etc. The centralized organization plan calls for executive control centering in Moscow. In the matter of production management, for instance, each factory is supposed to have its production manager, supervised by production managers for the city, the government and the whole of Russia. The same applies for all other departments of manufacture, such as accounting, stores, etc.

The function of the Supreme Council of National Economy is to operate, manage and control the entire means of production and communication. Under its control are all factories, railways, telegraphs and telephones. As subdivisions of this council are the departments of railways, metals, automobiles, etc. In Moscow for the machinery of the government alone there were about 230,000 employees getting an average wage of 40,000 to 50,000 rubles monthly although a few get much more. It is interesting to note that in this workers' republic, with equality for all and special privilege for none, 10,000 of these employees are classed, as responsible employees, that is, those who are faithful, loyal servants to the Bolsheviki and who get special food allowances and better wages. The Bolsheviki do not object to a mass of weak, starved, resistless working force as long as they can dominate and control it. That is the object of the 10,000 faithful followers who are better fed, clothed and provided for.

In contradistinction to the mass of small-salaried employees is that of one of the employees of the metals department of which Martens is the head. He is Marten's chief assistant and is a Finnish engineer. He draws about 400,000 rubles monthly together with small quantities of food, clothing and fuel. Even then the members of his family complain that they live only with the greatest difficulty and by drawing on private means. Characteristic of the difficulties which even the better than average government employee has in getting along is the experience of the foreman of the Russian American Tool Co., whom I found one Sunday morning cooking a meal. The previous day he had secured his monthly allowance of a few pounds of meat and a few vegetables and he was preparing them all for a feast. He told me that he had sold all his personal belongings, had no bread, so he had invited some of his friends to bring bread and have dinner. He was cooking his monthly rations at one time and he and his friends would eat it and of the future, well—that was another matter. As to the average employee the great question is to understand how he lives. The great mass of them is always hungry.

The communist theory of economic control is in itself quite ideal but its success presupposes the support of 180,000,000 honest and efficient Russians, all working for the public good and not for private gain. But all who know Russia know how impossible of realization is this prerequisite.

Factory Production Low

Beside their success in destroying and suppressing all opposition the Bolsheviki have succeeded in bringing down every one to the level of the lowest in pre-revolutionary times and in destroying all the wealth of Russia. Factory production is painfully low. Fine, large, and expensive automatic machines developed in the United States are standing idle for want of competent workmen. I believe there can be no appreciable production in Russia for years to come and the reason is clear: A painful shortage of materials, fuel, transport, trained workmen, clothing and food. Practically all industry is stagnant and what little individual and collective initiative is apparent from time to time is not directed toward activities that will result in economic readjustment. I made trips to Petrograd, Siberia, and many districts in the vicinity of both Petrograd and Moscow and found all industries on an extremely low-production basis and with lower morale. There is no incentive for the workmen. They have no wish to work and the hard conditions make any appreciable physical exertion impossible.

The Bolsheviki wished to have me act as an intermediary in securing American capital for Russian development. As a result I spent three or four weeks in conferences with expert specialists in the "Concessions Department" of the Supreme

Council of National Economy of which Rikoff is the head. With these specialists I went over the details of Russia's natural wealth—the forests of the north, the Don coal fields in the south, the great Kuznetskie coal fields in Siberia, irrigation in Turkestan, water power around Petrograd and in the south, and the Volga-Donn ship canal.

Finally, Rikoff said it was "not enough for you to see the reports and talk with the specialists, you must see these things for yourself." Though transportation is lacking for the ordinary human, for favored individuals it is available. Accordingly, Rikoff sent me to the railway department where I learned instructions had been given to give me the best train Russia could provide, consisting of a new locomotive, American coal cars with coal enough for the round trip, international pullman cars for myself and staff of experts, dining car, food and three train crews for 24-hour operation of the train, and an automobile for side trips.

Trips which I took included that to the Kuznetskie coal basin half way across Siberia, and to irrigation projects in Russian Turkestan. Upon activity in either of these places must depend the development of a market and with industry, the economical foundation and civilization of Russia destroyed as it is, there can be no excuse for such ventures from Americans. I can conceive of no capitalist investing his money so as to put it at the mercy of this robber band.

One Industry Escapes Nationalization

Of all the industries of Russia I found just one that had never been nationalized, in other words, one of which the owners had not been robbed by the aid of the automatic and the machine gun. This was the plant of the International Harvester Co. of America. The distinctive feature of the factory was that the old manager was left in control and was allowed to manage as best he could under the tremendous difficulty of government control of all labor, fuel, food, clothing, raw material, etc., without means of allotting an adequate supply. The manager, who is of German education and training, has succeeded in maintaining technical control of the plant and while his production was infinitesimally small it was not so bad as compared with other Russian plants.

The industrial situation is fairly well characterized in a letter which I wrote to Lenin in December, 1919, in which I said, "The red army has won at the expense of the industries—the bone and sinew of our modern life. The result is almost complete exhaustion of the ways of communication and production. Most of your men in power in the industries are without experience or technical education. It is hard for me to see how it is possible for them to succeed."

One is surprised by the almost complete absence of traffic on the railroads, both passenger and freight. The commerce of the nation is dead. All the business houses of the cities are closed, except the very small ones that have opened recently. Pavements and sidewalks are in great need of repair. Machinery and equipment are in bad condition and are getting worse daily.

Characteristic of factory production in Russia is that of the Amo automobile factory in Moscow built by private capital by special encouragement from the old government. It is a fine factory with a complete equipment of the best American machinery. There the Bolsheviki have a chance to succeed in factory organization and production except that Russia does not need automobiles as badly as it needs simple farm machinery, clothing, fuel and general household supplies. But Bolshevism will always waste much of its time on some fantastic whim rather than on practical necessity.

Futility of Bolshevist Endeavor

For full operation the factory would require about 6,000 men. At the time of my personal acquaintance with it, it had about 1,000 men and only two or three skilled mechanics. There was no raw material and very little fuel. A very little repair work was being done. The old government had bought a lot of light trucks for the war. As they were disabled they were sent to the factory, dismantled and the good parts assembled into good trucks again. After a while, however, they ran short of motor parts and had some ninety bodies without motors. They decided to build a motor. They worked all winter trying to get one good motor cylinder casting. They failed every time partly because of lack of skill and partly because of the absence of proper material. The manager at that time was a rather able Russian engineer who was hindered, however, on one side by a management committee of ignorant workmen who had authority over him. He had no power to hire, discharge, or discipline, without their consent. On the other hand he was given conflicting orders from the automobile building department in Moscow, the automobile repair department, the food operating department, the food repair department and the army repair and operating department. All his holidays were spent in hard physical work with a gang of men about the factory on the theory that all should be made to do some physical work.

Bolshevist Russia is visionary, impractical. Former professors, engineers, factory managers, railroad directors—able, honest, and energetic men—I found occupying themselves in electrification schemes, electric plows, electric transmission of power from coal fields, redistribution of the manufacturing industries according to an ideal plan, and writing treatises on such subjects as the automatic coupler for railway cars and elaborately-worked out plans of standardization. When the elaborate plan was made the problem was 99 per cent solved and nobody worried about its realization in practical everyday life.

All over Russia the fuel oil, coke, coal and gas burning furnaces, as well as locomotives, have been converted for wood burning. In the International Harvester plant there was not room for the larger wood-burning furnaces and the change would have completely upset the old arrangement and factory production system. The management insisted upon having coal and coke. Rikoff said, "We are unable to get coal and coke for you, but we think you can. We will give you trains and help and you can try for yourself." So in the spring of 1920 the manager's men made up a train carrying mine props and ran it to the coal basin in Ukrainia with red soldiers as guards and workmen. The trip was not successful.

The Fever of Locomotive Repair

One day I suggested to Lenin that the fundamental step in betterment should be locomotive repair. That, like electrification later, became a slogan of the administration. An order was issued that locomotives requiring repairs should be taken into all factories and that for every locomotive repaired the crew of workmen should receive a bonus in Soviet cash and be permitted to take the locomotive for a trip into the country and bring food for themselves.

As a result there was the strange spectacle of locomotive repairing shoved into all kinds of plants where previously there had been no spur tracks, no pits, and no proper equipment for skilled workmen. At the same time all the locomotive building and repair plants of Russia were standing practically idle. In the sight of the bonus and the trip to the country the locomotives got only a "lick and a promise" with the further advantage to the workers that they were soon back for a further bonus and another trip to the country.

Finally, one finds everywhere men even in high government offices who have no faith whatever in the ultimate ability of communism to cope with the economic situation. During the last month of my stay I was surprised at the openness of the criticism and expressions of discontent among not only workmen, peasants, and office workers, but also among high officials. In a talk with Martens' chief assistant, his secretary and an able engineer, he said; "When you first came to Russia there was still some hope of saving the industries or some remnant of them, but now it is absolutely lost and we must begin over from the beginning." To hear such statements from prisoners or from open revolutionaries would not be surprising, but from such high officials it sets one thinking, so say the least. In a trip through the Amo automobile factory with Martens I suggested that the building was new and of the finest and completely equipped with the best American machine tools. He replied, "Yes, but dead, absolutely dead."

Krassin, at the time I saw him Commissar of the De-

partment of Ways and Communication, was endeavoring to keep the railroads running though conditions in railway shops, locomotive and car shops, were little better than elsewhere. One day I was talking with one of the former railroad managers about Persia. I remarked that it was to me strange that Persia, a land bigger than the German empire, had no railroads. "Yes," he said, "but here in Russia there is one-sixth of the world's land area with no railroads but we are accustomed to them and feel their loss. Our industrial and economic life is built around our transport and without it we are paralyzed." Krassin saw and understood the situation yet he continued to support his Bolsheviki. It can only be assumed he has other motives. First, it gives him power, which he likes, and a good position, and second, he is in a position to direct the affairs of Russia into German hands. Of one thing I am sure—he is no Bolshevist. He is in the game, like most of the other, for the power and influence which it brings. He is a business man and an executive. Before the revolution he was manager of the big German Siemens-Halske factories in Russia employing 40,000 men.

Political Division of Russia

For my purpose I divide the population of Soviet Russia into five classes. The first class consists of the political idealist whom you could count on the fingers of your two hands. The second numbers a few thousand bold, unscrupulous, unprincipled bandits who are ruling with an iron hand and riding down all opposition. In these two groups are not over ten men who dominate all and wield the power and shape the policy of the whole mass. The third is composed of the balance of the Bolshevist party and numbers 90 per cent of its entire membership, or say 450,000. They are in the party because they are forced to be there by economic reasons. The fourth class is composed of the former wealthy people, the educated class, the artists and scientists and the politicians other than Bolsheviki. These the Bolsheviki are trying to exterminate. The fifth class is composed of the peasants and numbers more than 90 per cent of the Russian population. They are in general non-political, but at the same time are decidedly against the Bolsheviki. But they are an easy-going, gentle, non-resistant folk and the Bolsheviki have no trouble in dominating them.

I am convinced that Bolshevism must fail, first, because it has no inherent virtue or strength in it. There has been no benefit (except to the few hundred commissars and leaders referred to) to anyone. It has brought to all the people the greatest suffering and hardship with no compensation or prospect of anything better. Second, it has destroyed or is destroying the last remnant of Russia's past civilization. This destruction must go on until the end of the present regime. The first step toward reconstruction can come only with the end of Bolshevism. The Bolsheviki have not the executive ability, the technical skill, or the stability of character to enable them to turn the tide of retrogression. Third, public sentiment is decidedly against them. Nobody, not even the Bolshevist leaders, believes they can succeed. Everyone thinks that anything done on this economic foundation will be wasted effort and therefore no one makes the slightest effort at real conscientious work in support of the existing system.

The moral foundation of the present generation is also undermined. The failure of the educational system lies in bringing no preparation for future work, and therefore most people think it will be two generations before much progress can be made.

Private business has no foundation on which to build. But with a new stabilized government credit might be established and means of transportation rehabilitated which would make possible the opening of the coal and iron mines and the purchase of necessary manufacturing products. In the reconstruction Germany must take a direct hand as she needs Russia's raw material and has the technical and executive ability to carry out the reconstruction plans. America must have a large part in the financing and supplying of the necessary material. I hope to see worked out some plan by which the technical and executive ability of the Germans can be joined with American capital to the advantage of all countries concerned.

Triangulating Under Difficulties

By Herbert N. Bradstreet
U. S. Mineral Surveyor, Mesa, Ariz.

IN SUBDIVIDING the Hualpai Indian Reservation, whose northern boundary is the Grand Canyon of the Colorado, much difficulty was experienced in setting section and quarter-section posts because of tributary canyons, as high as 2,500 ft. and with almost perpendicular walls. As descent into these canyons was possible in only a few places, it was found necessary to survey the section lines to the edges of the canyons, flag the points and pick them up from the bottom of the canyons. The survey was further complicated by the General Land Office regulations which provide that no section is surveyed in its entirety unless the four mile corners and the four half-mile corners are set, or unless a witness corner for each missing corner is established within prescribed distances.

As a result of these conditions, the party in the canyons developed ability to scale anything but a vertical wall. Many a corner was triangulated into an almost inaccessible position and there established. To expedite these triangulations, the transitman developed a modification of the usual methods of triangulation which saved much time. Instead of occupying his instrument point until the flagman went ahead, lining him in, and then measuring a base and setting up at the other end, he sent his flagman ahead to a point approximately on line, going himself meanwhile with the chainmen to a point from which they could chain to the flagman. By the time the flagman had reached the objective point, the transitman had determined a meridian from solar observation and read the bearing back to the triangulation point, and was ready to read the bearing to the flagman. While the chainmen were chaining to the flagman, the transitman went to the flagman, set up his instrument and read the bearing back to the triangulation point. When the chainmen came up with the distance, it only remained to compute the length of the line triangulated, and to determine its latitude and departure. If the flagman was off line, a short move in one direction or the other put them back on line.

While this method is not particularly accurate, it will give results well within the 1 in 640 limit required by regulations. It saves the time which is usually lost while the flagman goes ahead; it eliminates all backtracking, and keeps the party together. Furthermore it eliminates all possibility of measuring a base and finding upon setting up at the other end, that the objective point is invisible.

Allowable Salinity in Water Supplies

In a paper discussing salinity in irrigation and potable water supplies, read before the San Francisco Section, Am. Soc. C. E., T. H. Means made the following comment on the allowable salinity:

The amount of salt which is safe in a domestic water supply is variable. What would be regarded as too salty in Massachusetts would be considered excellent water in Arizona. While no exact limits can be set it may be said that with one thousand parts per million, water must be used with caution and when two thousand parts per million are present there is great danger of damage to the crop and the soil. Pure ocean water contains 3½ per cent salt or 35,000 parts per million. A mixture of one part ocean water with one hundred parts fresh water would make a domestic supply questionable, while for irrigation purposes the mixture might be as strong as one to twenty for short periods.

New York City's Largest Pier Project Near Completion

Stapleton, Staten Island, Development Involved Huge Construction Program—Good Progress Record Despite Difficulty in Materials Delivery—Methods Employed in Piledriving and Concreting

A STEAMSHIP pier development at Stapleton, Staten Island—the largest yet undertaken by New York City—work on the twelve piers of which commenced in May, 1920, is nearing completion. The development was described in *Engineering News-Record*, May 27, 1920, p. 1047, when it was noted that this was not only New York City's largest pier project to date, but also the first time that the city had undertaken a project on the west side of the harbor with direct rail connection by the railroads from New Jersey. The work that has gone forward in the past sixteen months involved a huge construction program, carried out with a good progress record despite the difficulty

AIRPLANE VIEW OF NEW YORK CITY'S PIER DEVELOPMENT AT STAPLETON, STATEN ISLAND

in securing the delivery of materials during the early stages of the work. The twelve piers are each some 1,100 ft. in length and vary in width from 125 to 209 ft., with 300-ft. slips, and with one- and two-story sheds. Two of the piers—of 209-ft. width and two-story shed—are designed with double marginal tracks and half gantry cranes along each side.

Work on all twelve of the piers was started in May, 1920, under contract by six companies with the New York City Department of Docks. Last April work started on the construction of the sheds under contract with two firms. The Terry & Tench Co., Inc., general contractors, New York City, built piers Nos. 6 to 11, inclusive, and Smith, Hauser and MacIsaac, Inc., built the two large piers Nos. 12 and 13. Other piers were under contract as follows: Pier 15 by George B. Shearin, Inc., work completed Feb. 20, 1921; pier 16 by Snare & Triest Co., completed May 14, 1921; pier 17, Barth S. Cronin Co., completed May 14, 1921; and pier 18 by Phoenix Construction Co., completed July 1, 1921. Smith, Hauser & MacIsaac completed work on the two large piers last September, and the Terry & Tench Co. completed their contract on piers 6 to 11 last May. Work is still in progress, completing construction of the sheds on several of the piers.

At present the two tracks of the Baltimore & Ohio R.R. parallel the shore back of the bulkhead line of the new piers. The new bulkhead was established 100 to 400 ft. from the old shore line. The intervening area is now being filled in to provide for track connections and warehouse development. By connection with the Baltimore & Ohio R.R. over the Arthur Kill, access is had to all of the railroads entering the port from the New Jersey side. Following announcement of plans for the piers there was considerable public criticism of the design with particular respect to pier width and freight-handling machinery. The City of New York takes the position that under existing legal limitations the type of pier, the shed, and the handling equipment must be suited to the lessees previous to the final adoption of the design. In each case these general requirements were determined in advance by the firms leasing the piers.

Terry & Tench Contract.—The contract for the six piers by Terry & Tench was signed early in 1920. The piers were about 1,100 ft. long by 125 ft. wide, with 3,000 lin.ft. of bulkhead. In spite of the fact that orders for piles and timber were immediately placed for the earliest possible delivery, congestion on the railroads delayed the commencement of the work until May 5, 1920, when piledriving was started, and then only by getting a small supply of spruce and oak piles locally, although it was originally planned to put six piledrivers on the work. Work was accordingly started with two piledrivers, three derrick boats, one shop scow fitted up as a machine and blacksmith shop, a gasoline tug, and several scows for transporting materials. Later on, as materials began to arrive in quantities, derrick boats and additional piledrivers were added until five were working, the maximum number used. It was originally intended to have practically all materials lightered to the site, but this plan had to be abandoned at the outset on account of congestion in the Jersey City freight terminals. A spur track from the Staten Island Rapid Transit Ry. was constructed, starting at a point opposite pier 10 and paralleling the bulkhead for 1,000 ft., provided with a 300-ft. passing track. It was not until October, 1920, when the railroad situation had improved and the coal trade had released a large number of barges, that it was possible to get enough piles to keep five drivers working. From this time on work was pushed to capacity.

The following quantities of materials are a striking indication of the size of this contract. For the six piers there were required 24,000 piles of 40 to 89-ft. length, 4,000 M.ft.b.m. of timber, 612 tons of fastenings, 26,000 cu.yd. of concrete, and 1,243 tons of reinforcing steel. For the bulkhead there were required 7,000 piles of 45 to 50-ft. length, 1,000 M.ft.b.m. of timber, 105 tons of fastenings, 3,600 yd. of concrete, and 29,000 cu.yd. of riprap. Piledriving was started May 5, 1920, and finished May 12, 1921. Concreting was started Nov. 8, 1920, and finished May 19, 1921, with an interval of one idle month on account of gravel pits being closed. In October, November and

December, 1920, 12,000 piles were driven with five machines.

In order to command the siding and the catamarans in front of the bulkhead, piles delivered by rail were unloaded by two 10-ton stiff-leg derricks at this point, so that piles could be sorted and placed on the catamarans with a minimum of handling. Piles received on barges were unloaded to catamarans direct and sorted later with floating derricks. The offices, storehouses and power plant were established back of the old bulkhead and adjacent to the siding between piers 10 and 11. All fastenings, castings, small lumber, etc., were delivered at this point by trucks or rail, and then handled on small scows to different parts of the work as required. The power plant for pneumatic tools and machinery consisted of two steam driven compressors of 300 cu.ft. per minute capacity and two electrically driven compressors of 600 ft. capacity.

ONE OF THE TWO LARGEST PIERS UNDER CONSTRUCTION, PIER 13 UNDER CONTRACT WITH SMITH, HAUSER & MACISAAC DURING EARLY STAGES OF WORK

To fulfill specifications for pile bearing, it was found necessary to lag about 2,800 of the long piles with 5 x 6-in. timbers bolted on to the lower 30 ft. This work was done mostly on the piers where the concrete deck had been placed, and partly on the bank at one of the unloading derricks.

The new bulkhead on the Terry & Tench contract was located for the most part 100 to 300 ft. off shore. Access to the piers was provided by driving two-pile bents spaced about 18 ft. apart and located about 50 ft. inshore from the new bulkhead location, carrying a boardwalk and pipe lines, and also serving to anchor booms for forming temporary storage of timber. This temporary construction paralleled the location of the new bulkhead for the entire length of the work. Connections between this walk and the piers were made by float stages. Two lines of 3-in. pipe were run on each pier for air and water from the main line that paralleled the bulkhead.

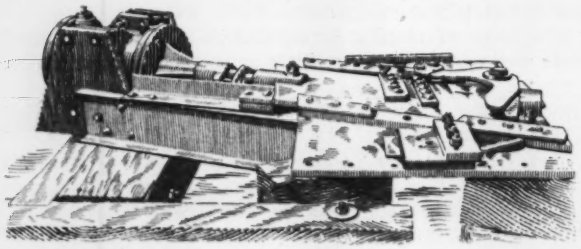
For framing and handling the timber a derrick boat was fitted up with a band saw and a 5-ton derrick, located in the basin inside the boom where the timber was stored. All the timber required for framing was handled by this scow to the saw and then placed in rafts to be towed to different piers. Each of the 12 x 12-in. pile caps had four half splices from 4 ft. to 6 ft. long. The side caps had 4-ft. chip splices. All of this framing was done by the band saw which saved a great deal of labor beside the material sawed out for the splices being made available for scabs, fillers, etc. Since there were over 3,000 splices, with 18-ft. b.m. saved in each, a total saving of over 50,000 ft. b.m. of timber was accomplished. The pile caps were made up into three units, the center section consisting of a 10 x 12-in. timber, 36 ft. long with a 6-ft. half splice on each end. The side sections were about 53 ft. long with a corresponding half splice on one end. These sections were composed of two and sometimes three pieces of timber butted together and spliced with 6 x 12-in. scabs. The splicing of these sections was done in the framing scow and the sections placed in rafts and towed to various points on the work.

The work of placing forms and reinforcing for concrete was on such a large scale as to require standardization of various stages of the work. The forms for the 10-in. deck slabs were made up in panels of 2 ft. 8 in. wide by 9, 12, and 14-ft. long, of 1¼-in. lumber dressed to 1⅛ in. The panels were supported by joists 2 x 8 in. x 9 ft. resting on 2 x 3 strips secured to the sides of the cross-caps by lag screws. A pneumatic wood-boring machine with a suitable socket wrench was used for placing and removing the lag screws. On the entire job some thirty-five pneumatic wood-boring machines were in use at one time in connection with concrete formwork and boring for fastenings in pier construction.

Of the 1,243 tons of reinforcing bars used, about 1,100 tons of ⅝-in. square bars, totaling 79,000 pieces, required bending to the same shape. Two special machines were designed for doing this work, a sketch of one of which appears herewith. They consisted of a 10-in. hydraulic cylinder bolted between two channels about 6 ft. long to the lower flanges of which a 1-in. plate 36 x 36 in. was riveted. To the piston rod was bolted a ¾-in. plate shaped to suit the bend to be made and moved between two guides riveted to the plate. To form a 3-in. hook on the end of bars a heavy bell-crank was secured to the 1-in. plate, one end of which was engaged by the piston at about half stroke. At the end of the stroke the side of the bell crank in contact with the bar was forced around to a position at right angles to the long axis. The machines were operated by compressed air at 90 lb. per sq.in. pressure. They were located on the edge of the bulkhead within reach of one of the unloading derricks. Two machines and three helpers would bend from 1,000 to 1,400 bars in eight hours.

A floating concrete plant built on a derrick boat 30 x 110 ft. was used to give ready access as a large unit to all parts of the work. The plant was equipped with a 75-ft. boom handled by an independent swinging engine and side guys operated by a two-drum hoisting

engine. The plant is shown in the photograph herewith, with the placement of concrete and reinforcement by slabs in the foreground. At the forward end of the boat the 50-ft. wooden tower with a 30-cu.ft. capacity hopper at the top was provided. It was equipped with a 50-ft. steel boom and 48 ft. of standard chute with a 32-ft. counterweight chute. The tower elevator bucket, serving the hopper, was operated by a



HYDRAULIC CYLINDER IMPROVISED TO BEND STEEL REINFORCEMENT

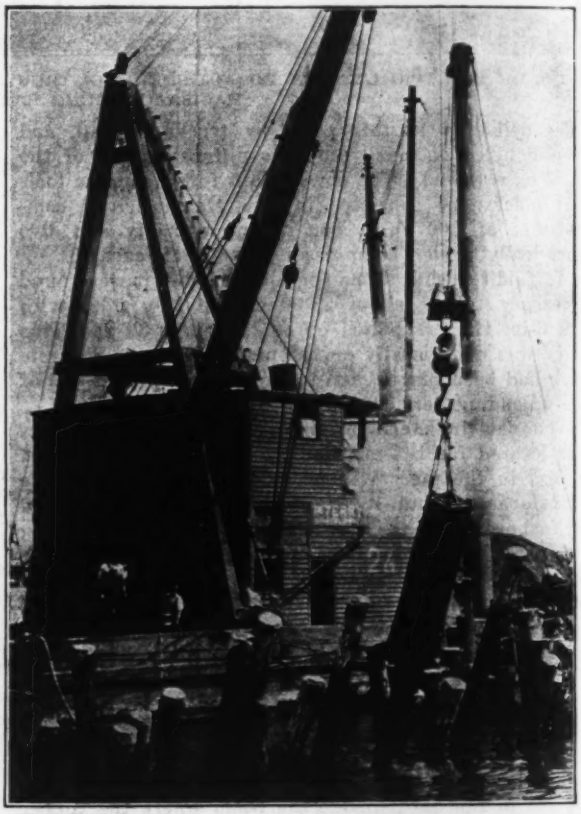
steam hoist. A 1-cu.yd. mixer was placed directly behind the tower. The deck of the scow under the tower was cut out to allow the bucket to be lowered so that its top was even with the deck. The mixer was set on the deck and dumped directly into the bucket. A 25-cu.yd. bin supplied gravel to the mixer. At the elevation of the top of the batch-hopper of the mixer, the mixing floor was laid across the entire width of the scow, and over the area occupied by the mixer and bin, roofed over at the elevation at the top of the bin to provide a large room in which enough cement was stored to tide over any contingencies in handling. Ready-mixed sand and gravel was used on the work. All materials were delivered by scow. A cement scow with a capacity of 8,000 bags was always kept loaded, to take care of any delays in delivery of cement.

In operation the floating concrete plant was placed heead on to the side of the pier, with a gravel barge on the one side and cement barge on the other. The gravel was delivered to the bin by the clam-shell bucket, and the cement through an opening in the roof to the mixing floor by the derricks on the cement barge. The mixer was run at 20 r.p.m., resulting in a capacity of sixty batches an hour, frequently attained for each of the 8 hr. of the working day.

All of the 2,200 brace or batter piles in the piers and bulkhead were driven with a McKiernan-Terry No. 9-B steam hammer, swung from the falls of a derrick boat, as indicated in one of the photographs. The hammer was swung on a suitable bridle so that it hung at the same angle as the brace pile and was fitted with a sleeve of 16-in. diameter pipe 4 ft. long, acting as a lead. From twenty to thirty piles would be loaded on the deck of the derrick boat and these set at the proper angle for driving. The hammer was then placed on the pile, which was guided by guy ropes from the derrick scow. From fifteen to twenty-five piles were driven in 8 hr. with this rig and a crew of seven men. The maximum driven in one day was eighty-eight, which had been previously placed for driving. When the derrick boat was not engaged in driving batter piles, it was available for other purposes. By the use of this method it was unnecessary to take a regular piledriver off the work on bearing piles, where they were used exclusively.

Smith, Hauser & MacIsaac Contract.—Heavy concreting and footing work was involved in the construction of piers 12 and 13 by Smith, Hauser & MacIsaac. These piers, the two largest of the Stapleton development, while presenting no unusual difficulties in construction, were delayed in their completion, as was the Terry & Tench contract, by the inability of the contractors to obtain materials, principally piling and timber, due to railroad embargoes and congestion. A general view of the early stages of the work on pier 12 is shown in an accompanying photograph.

As the delivery of materials by the railroad improved, more piledrivers and larger framing crews were put to work and at the peak close to 500 dockbuilders and piledriver men were employed. The piledriving at the inshore end and along the line of the bulkhead wall was quite hard, and piles of 45 to 50-ft. lengths were sufficient. As the work progressed, longer piles became necessary until at 600 ft. from the bulkhead line piles of 90-ft. length were used, and at 650 ft. even a 90-ft. plain pile would not drive according to specifications. Therefore, lagging was resorted to. The lagging of piles with as little handling as possible was successfully met



BATTER PILES DRIVEN BY STEAM HAMMER, HAMMER GUIDED BY 14-IN. PIPE SLEEVE AND PILE HELD IN POSITION BY ROPE GUYS

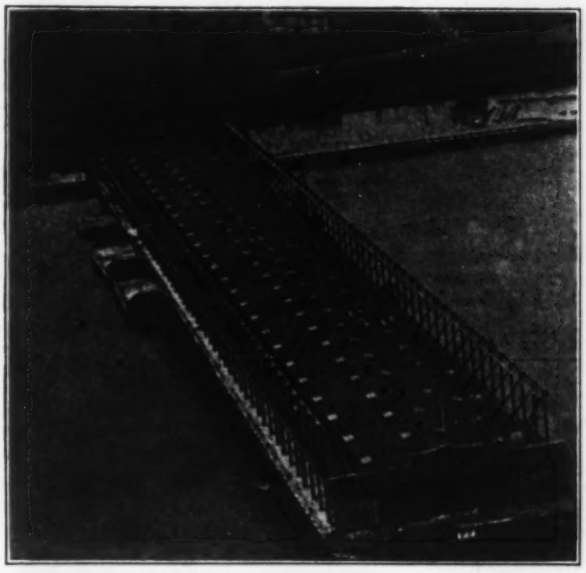
by building two lagging platforms across the caps of completed bents with the inshore end of pier 12. Along the track deck at the south side of the pier, a temporary track was laid, which supplied lagging lumber and bolts to the platforms. A floating derrick at each platform handled the piles from and to catamarans, which were then sent to the drivers. The

lagging consisted of two sticks of 5x6 timber 30 ft. long applied at the tip end of the half lagged piles and four sticks of the same length for a full lagged pile. Timber was fastened to the piles with 1-in. bolts. Before this type of lagging was adopted, several other types were tried and test piles driven proved conclusively the superiority of the type used, in the opinion of the contractors and the dock department.

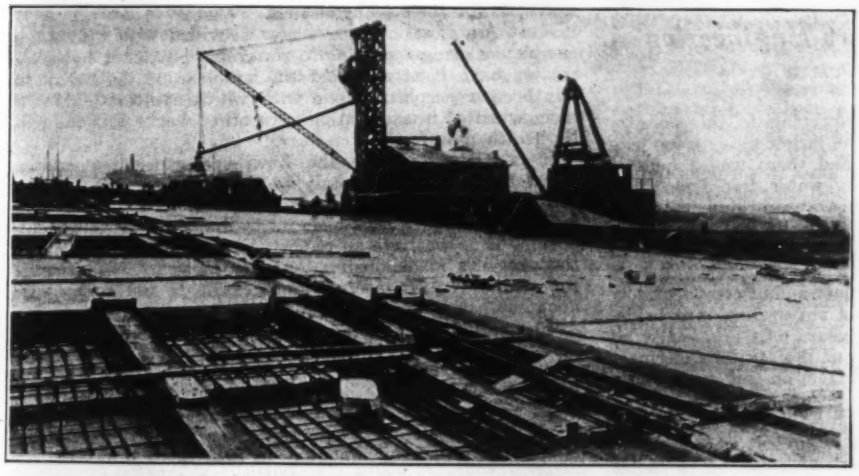
The timber work closely followed the piledriving and little trouble was experienced. Electric drills were used at first, but did not prove entirely satisfactory to the contractors since the light drills appeared to lack power and the more powerful types were too heavy for easy handling. Electric drills, however, were used with great satisfaction at the lagging platforms, and pneumatic drills on the construction.

The material was unloaded by locomotive crane, and piled in stock piles in the yard behind the piers. As materials were needed on the work, they were loaded on deck scows and distributed. Handling materials by hand was eliminated in so far as possible, resulting in a large saving to the contractor.

In October, 1920, concreting operations were started and carried on through the winter months to February, 1921, being resumed in March and carried to completion in June, 1921. All of the concrete was placed by a floating plant similar to that used on the Terry & Tench contract, with a 60-ft. steel tower and chutes, bins for storage of materials which were discharged directly into a 1-cu. yd. mixer. Premixed sand and gravel was loaded into the storage hoppers from scows by the derrick in the stern of the concrete scow and cement was unloaded from barges by common labor. The limited length of the tower and the short chute section used made it impossible to pour more than halfway across the pier, and the mixer then moved around to the other side to complete each section. The column footings were poured first, and were kept well in advance of the slab form work. The slab forms were supported on 3x3x¼ in. angles fastened to the caps with 4-in. lag screws 24 in. on center. The forms were built up in panels with 1x8-in. battens to hold them together. The beams were not fastened to the panels but were set on the angles on 20-in. centers for the main slab and 16-in. centers for the track slab. The slab panels were then laid on the beams and only fastened sufficiently to hold them in place. All work on the substructure of these piers was completed in July and turned over to the Department of Docks of the City of New York during August.



PHOTOGRAPH FROM HARBOR SIDE SHOWS SHED NEARING COMPLETION



FLOATING CONCRETE PLANT IN OPERATION. SAND AND GRAVEL SCOW ALONGSIDE PLACEMENT OF REINFORCING AND POURING BY SLAB SECTIONS SHOWN IN FOREGROUND

Work is now in progress completing the building of the pier sheds. The Snare & Triest Co. have the contract for the sheds of piers 15 and 16 and the sheds for piers 17 and 18 and being built by the McHarg H. Barton Co.

The work was carried out under the direction of Murray Hulbert, commissioner of docks, New York City, and under the immediate direction of T. F. Keller, chief engineer of the Department of Docks.

Motor Vehicles on Farms

The number of farms which had automobiles on Jan. 1, 1920, according to a recent announcement of the Bureau of the Census, Department of Commerce, was 1,979,564, or 30.7 per cent of all farms in the United States. These farms reported a total of 2,146,512 automobiles on the census date. The following states reported more than 100,000 automobiles on farms in 1920: Iowa, 177,558; Illinois, 139,090; Ohio, 128,384; Kansas, 111,055; Minnesota, 107,824; Texas, 105,292; Nebraska, 104,453; and Indiana, 102,122. Motor trucks were reported on 131,551 farms in 1920, or about 2 farms out of every 100 in the United States as a whole. The number of motor trucks on these farms was 139,169.

Sanitary Engineering Problems and Progress

Abstracts of Papers, Reports and Discussions at the A. P. H. A. Meeting and the Am. Soc. C. E. Sanitation Conference, New York City, Nov. 14 to 18

Some forty papers and reports were presented and discussed during the fiftieth annual convention of the American Public Health Association, Nov. 14 *to* 18, *and the conference on Sanitation Problems held by the American Society of Civil Engineers the same week, both as reported in our issue of Nov.* 24, *p.* 869. *Abstracts, necessarily brief, follow. The first paper, by George W. Fuller, was presented before one of the general sessions of the A. P. H. A. The papers grouped under "Stream Pollution and Sewage Disposal," "Odors and Their Travel Habits" and "Water Supply and Water Purification," were read at the Am. Soc. C. E. Conference. The other papers and reports dealing with water, sewage, sanitary control of bathing places, milk pasteurization, mosquito extermination and health aspects of zoning, were presented to the Sanitary Engineering Section of the American Public Health Association.*

* * *

Fifty Years of Sanitary Engineering

By George W. Fuller
Consulting Engineer, New York City

Fifty Years Ago sanitary engineering in this country scarcely existed, even in name. The larger cities were provided with public water supplies and there was a general desire among sanitarians to supply water free from filth. Sewers in combination with storm-water drains had been built in the larger communities to a limited extent for several decades. The germ theory of disease had not been established. The laboratory man spoke of chemical tests in terms unappreciated by the engineer and of comparatively little aid to him. Bacteriology had not sprung into being. In brief, the history of the past 50 years tells practically all of the substantial accomplishments of the sanitary engineer in advancing the public health movement on this continent.

Water Supply and Water Purification

In 1870 most American water supplies were muddy, colored, polluted and frequently objectionable as to tastes and odors. Typhoid fever death rates were high. The laboratory men were studying hardness, lead-poisoning and methods of measuring dead organic matter in water. The art of filtration was practically unknown in this country, except in so far as efforts to get clear water in European cities had been revealed by the classical publication of Kirkwood.

Today there are more than 800 filter plants in operation in this country and Canada, serving more than 20,000,000 of people, or more than one-third of the population resident in cities and towns. In scores of cases heavily polluted sources of supply have been abandoned in favor of new and comparatively unpolluted sources.

Typhoid fever annual death rates of representative cities on this continent ranged, 20 years ago, from about 15 to 50 per hundred thousand population. In a number of large and well known cities these figures reached 75 to 100 or more. Today the death rates have dropped in many of those same cities, largely as a result of preventing or removing the pollution of public water supplies, to nearly one-tenth of the rates prevailing 20 to 30 years ago.

About a dozen years ago the so-called sterilization or chlorination or disinfection of water supplies was proposed by Col. George A. Johnson, as a means of removing objectionable bacteria. Its use has become widespread, particularly as a factor of safety to be applied in connection with filtration processes. In many cases, however, its use has resulted in a falling off of the quality of filtered water, largely for the sake of economy during the war period, so that instead of being a factor of safety, chlorination has quite frequently become a substantial portion of the process for the elimination of objectionable bacteria. Undoubtedly, the pendulum swung too far and there is now a pronounced reaction whereby higher accomplishments are demanded of filter plants themselves. This affects the size of sand used in filter beds, the quantity of coagulant, the skill with which filter plants are operated, and other technical details which are receiving deserved attention.

Drainage, Sewerage and Sewage Disposal

Drainage is an important element in relation to the public health, as shown by the fact that the drainage works installed some 20 years ago at New Orleans had a more beneficial effect upon the health of that community than did the installation in subsequent years of modern sewerage and modern water supply works. The engineer has had to deal with drainage to eliminate the mosquito and thus keep under control those diseases that require an insect as a vehicle for their transmission.

Most American cities are now provided with moderately complete arrangements as to sewerage, but after household wastes have been collected the problem of their disposal has been a perplexing one with which sanitary engineers have wrestled in association with other workers in the public health movement.

It is 34 years since the Lawrence experiment station was founded and fortunately we have a statement prepared for the Engineering Congress held in St. Louis in 1904, indicating the progress made up to that date in sewage disposal. Thus we have an opportunity of comparing roughly the progress made during the first 17 years with that of the second 17 year interval since 1887. In 1904 there were about 90 sewage-works in operation in cities and towns of 3,000 population or more, of which the total number in the United States in 1900 was 1,524. At that date about 1,100, or roughly about 75 per cent of the cities and towns, had more or less complete sewerage systems. The 1904 statement as to municipal plants does not include several hundred disposal plants in smaller towns, hotels, institutions and industrial establishments. In 1915 there were over 600 treatment plants for municipalities on this continent and about 300 institutional and private plants for hotels and industrial works. War activities interrupted municipal construction but several important plants have been completed since 1915.

Without getting into details of methods now in vogue, it may be noted that in the results accomplished at numerous plants for treating sewage, either in single- or two-story septic tanks or by stone beds, which financial considerations have necessitated as substitutes for sand beds, one is frequently surprised with the difficulty of getting efficient results uniformly in an inoffensive way. In part this is due to lax arrangements in the system of collecting sewers, in part it is due to inadequate or overtaxed disposal plants, and in part it is due to inadequate attention in the management of plant operations.

Activated sludge is the newest method of sewage treatment. It is a process which makes feasible a more complete purification of sewage than is readily secured by any other method than sand filters. It requires conscientious supervision but I am beginning to believe that since few if any sewage disposal plants are fool-proof, it is perhaps an advantage, rather than a disadvantage, to the process to call for frequent and efficient supervision. During the war, when very high prices prevailed for fertilizers, it was hoped that the drying of activated sludge would produce a commercial product that could be sold to the fertilizer trade

for a price which would offset the cost at least of handling the sludge itself. This is not certain under present circumstances but again we must recognize that this is necessarily not a fatal drawback and that if real accomplishments in treating sewage are to be effected in a sanitary way, the price must be paid in both money and intelligent direction.

Progress in sanitary engineering in the field of sewage disposal is more associated with availability of funds than perhaps is generally realized. It is more difficult to secure funds for disposing of these waste products than it is to get money for water supply improvements, or a new hospital, or new playgrounds, or new street pavements.

STREET CLEANING AND SOLID WASTES DISPOSAL

These subjects are properly included in the scope of sanitary engineering and in this country progress has been substantial. Accomplishments for the most part have followed European precedents but have not attained as satisfactory results, generally speaking, as found in the better known European cities.

The epidemic of infantile paralysis in 1916 and the outbreaks of influenza during the war stimulated street-cleaning in some cities to a substantial extent; but depleted funds and restrictions in capacity of water-works have caused some municipalities to fall back to a standard of accomplishment lower, rather than higher, than that prevailing just prior to the war.

The sanitary engineer is able to bring about in an effective way the sanitary disposal of solid wastes. Overtaxing of plants and difficulties from odors have been more pronounced than should have been or need be the case. Even in garbage reduction works the control of odors by passing the released gases through combustion chambers maintained at a very high temperature and their passage through curtains of water spray are things which the engineer knows about but which have not ordinarily been put in practice

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Stream Pollution and Sewage Disposal

Tanks and Fine Screens for Treating Sewage: George T. Hammond, Consulting Engineer, Brooklyn, N. Y.—The bad name lately attached to the Imhoff tank is largely due to faulty design and due even more to poor operation. This tank will remove considerably more suspended matter than will screens, but the freshness of sewage from screen treatment sometimes more than offsets the lesser degree of clarification that it effects as compared with the Imhoff tank. Separate sludge tanks are becoming prominent, but there is not yet much uniformity in their design.

Pollution of Tidal Harbors by Sewage: Kenneth Allen, Sanitary Engineer, Board of Estimate and Apportionment, New York City—The effect of back-and-forth tidal flow and the different specific gravities of sewage and of salt water have to be taken into account. At points in the East River in October of this year samples collected for analysis showed no dissolved oxygen.

Storm-Water Treatment: John F. Skinner, Principal Assistant Engineer, Department of Engineering, Rochester, N. Y.—In some cases heavy solids may be removed from storm water by sedimentation in grit chambers and light solids by screening. A combined grit chamber and screening installation may be used, the screens to be in the form of inclined baffle racks at intervals of about 25 ft. longitudinally in the grit chambers. Thus far little has yet been done in the way of storm-water treatment in this country but more may be expected in the future.

Policies of Pennsylvania Department of Health: W. L. Stevenson, Assistant Chief Engineer, Pennsylvania Department of Health, Harrisburg, Pa.—Polluted surface wash makes it out of the question to use surface waters for public water supplies without treatment. The greatest protection to the public can be secured with least expense by combining sewage and water treatment. In general, where no water supply is taken from the streams the cleansing of a river would proceed from upstream downward, whereas if a public water supply were involved the cleansing would begin at the sewage-works next above the water intake and be extended upwards.

Steam Pollution and Its Control: Earle B. Phelps, Consulting Sanitary Engineer, New York City—Three essentials must be considered: (1) capacity of stream both as to volume and biologically; (2) the pollution load, present and prospective; (3) remedial measures. The newer chemistry of stream pollution considers oxygen demand instead of nitrogen content. Engineers should design for the utilization of a stream as well as for its protection. Legislation for the protection of streams from pollution should give wide dicretionary powers of administrative control instead of containing specific restrictions.

Sludge Disposal: T. Chalkley Hatton, Chief Engineer, Milwaukee Sewerage Commission—In sewage-works practice more attention has thus far been given to the treatment of the liquid portion of the sewage than to the disposal of the sludge. Inspection of sludge dumps in England and elsewhere indicates that the sludge disposal problem is not yet half solved. In my recent trip to England I saw no improvement in sludge disposal over my preceding trip. I was informed by the Ministry of Health that as soon as British cities are in better financial condition they will be forced to make improvements in their sludge disposal methods. This side of the Atlantic, bad sludge conditions have been noted at Toronto and at Baltimore.

Except where lime is used in treatment, there is no reason why sewage sludge should not be utilized. In Germany I found that much attention was being given to sludge disposal. I observed but little sludge around sewage-works there and found that it was being used on farms. Recent experience in sludge disposal at Rochester indicates that other communities as well might get enough from their sewage sludge to pay for its dewatering.

At Milwaukee, after five years, of study, while we have not yet solved the sludge treatment problem to our satisfaction, we have been able to reduce the moisture content to 10 per cent by pressing and drying (activated sludge) and if the former prices of fertilizing material are restored we may expect to handle our Milwaukee sludge at a profit.

The Dilution Factor: Langdon Pearse, Sanitary Engineer, Chicago Sanitary District—From the viewpoint of nuisance prevention a sewage dilution of 4 to 7 sec.-ft. of stream flow per 1,000 population has been indicated with a lower limit of 2 and an upper of 10. The Sanitary District of Chicago has sought for a different standard and favors the biochemical oxygen demand test. Continued tests on sewage from a large sewer serving 300,000 people, with no marked industrial wastes, have given an equivalent of 0.22 lb. of oxygen per capita for complete oxidation, based on ten days' incubation in sealed bottles and taking no account of re-aeration. The latter should reduce the dilution factor. Of the oxygen requirement roughly about 20 to 30 per cent seems to be necessary in the first 24 hr. The required dilution will be much higher in warm than in cold weather as shown by the following figures for (1) dissolved oxygen, p.p.m.; (2) temperature corresponding to dissolved oxygen saturation, deg. Fahr.; (3) flow required in sec.-ft. per 1,000 population: 6-108-6.80; 8-81-5.09; 10-60-4.07; 12-46-3.40; 14-35-2.92. Observations on the main channel at Chicago appear now to indicate that a higher dilution is required than the minimum of 3.33 sec.-ft. per 1,000 population to dilute the raw sewage of domestic origin in the summer, a figure between 4 and 5 sec-ft. now seeming more likely. With an industrial load at times over 50 per cent of the human load, the need is apparent of much higher dilution for both domestic and industrial sewage combined. The exact figures will depend on re-aeration factors and seasonal conditions, such as temperature and extent of ice sheet, as well as the standard of dissolved oxygen to be maintained at critical points.

From the standpoint of fish life, considerable oxygen is required. Fish specialists suggest today not alone the study of the oxygen content, but also the CO_2 and the H-ion concentration.

An extended investigation of the self-purification of the sewage of the Sanitary District of Chicago from Lake Michigan to the Mississippi River is now being made jointly by the United States Public Health Service and the Sanitary District of Chicago. Re-aeration, temperature, the ice sheet,

the time or length of travel, and also sludge travel are to be studied and existing data will be summarized. With the work already done by the Public Health Service on the Potomac and Ohio rivers, this third investigation should provide very useful data.

The dilution required to prevent an undue load upon water purification plants appears to have been first cast in definite form by the International Joint Commission which suggested an average load such that the raw water would not contain as a yearly average more than 500 B. Coli per 100 c.c., or, as translated by Prof. Phelps, a dilution of 5 sec-ft. per capita or greater.

Misuse of Sewers: W. H. Dittoe, Engineer, Ohio State Board of Health, Columbus—Abuse of both sewers and sewage-works exists through the failure of city authorities to control connections. Sanitary engineers who have left this matter to city officials should take the lead in laying down proper rules for making connections. There should also be a protection of sanitary sewers against the reception of storm water and of storm sewers against receiving sewage. All these things require proper municipal ordinances, enforced, together with permits for making sewer connections, records, and the like.

General Discussion—J. Frederick Jackson, engineer, Connecticut State Board of Health, said that the Connecticut Industrial Wastes Commission had been discontinued by the legislature largely because the commission could not see its way clear to support a very drastic measure against stream pollution. Glenn D. Holmes, engineer, Intercepting Sewer Board, Syracuse, N. Y., in commenting upon indications there in favor of plain sedimentation, said that the detention period rather than the velocity was the thing to be considered. F. A. Dallyn, engineer, Ontario Provincial Board of Health, remarked on it being fortunate that biologists were included in the current discussion. This led W. F. Wells, sanitary biologist of the New York State Conservation Commission, Albany, to state that as a biologist he felt encouraged to go on with his work. There is need, he said, of some way of bringing recognized principles for the protection of fish to public attention. Rudolph Hering, New York City, stated that the dilution recommendation originally made for the Chicago sewage was 4 sec.-ft. per 1,000 population instead of the 3½ ft. finally adopted. Had this and other of the original recommendations, including the dredging of sludge from the Chicago River, been followed better results in the drainage canal would have been secured. Alexander Potter, consulting engineer, New York City, endorsed Mr. Dittoe's remarks as to the misuse of sewers. C. M. Baker, engineer, Wisconsin State Board of Health, Madison, said that the State of Wisconsin inspects plumbing and that the work is fairly controlled. Paul Norcross, consulting engineer, Atlanta, Ga., expressed agreement with Mr. Hatton's remarks as to the present status of sludge disposal and said further that he thought existing sludge disposal conditions was one of the reasons for the condemnation of sewage-works by laymen; also that at one of the three Atlanta sewage-works sludge disposal conditions had caused litigation.

* * *

Odors and Their Travel Habits

Synopsis of Paper by L. L. Tribus, Consulting Engineer, New York City—(The full paper was printed in the October Proceedings of the American Society of Civil Engineers.) This paper is more a rambling collection of notes about "smells," with some incidents illustrating their intensity, prevalence, persistence and movements, than a logical engineering presentation of a definite subject, with conclusions, as a suggested guide to follow. In fact, definiteness as to smells is impossible, even as to any standard of describing them, and the paper makes a point of that fact.

The tolerance of odors given off by essential industries, if due care is taken to reduce offence to the minimum, is considered, the effect of odors upon persons of different susceptibilities is discussed, and the fact that certain races accept as pleasing those odors which produce even disgust in others is noted. Some notes are given in regard to difference of behavior during daylight and night, particularly the curing effect of direct sunlight.

Observed distances of travel of odors are given in numerous instances, and various cases from litigation are reviewed, giving opinions of unnamed experts as to their views upon distances to which odors travel, and the atmospheric conditions under which they become specifically obnoxious.

In general, the types of odors reviewed are those from garbage treatment and sewage disposal works, with some comments upon the production of offensive gases in the preparation of food products, ore and oil refining, etc.

The writer's conclusions are that many engineers ought to give items from their own experiences, so as to provide a reservoir of information that might be helpful in settling various disagreements and even litigation; that chemists might devote more attention to counteractive work; and that some consideration might be given to amendments to public health laws to make possible the stopping of prospective nuisances without having to wait for their actual development before effective action can be taken.

Physiology and Government Control of Odors: George C. Whipple, Professor of Sanitary Engineering, Harvard University, Cambridge, Mass.—The direct effect of odors upon health is small, but there may be considerable indirect effect by their causing loss of sleep and extended worry. The fact that human beings insist that health and comfort be not separated is recognized by the courts. In the last analysis, decision as to whether a thing is a nuisance depends upon the conclusions of twelve good men are true. As time goes on the police powers in this direction will be extended. In granting building permits for chemical or other industrial plants, the authorities should take into account the likelihood of nuisance. City zoning helps in controlling nuisances of the kind, but does not go far enough because while the buildings may be confined to a given zone, the odors are not. Before granting permits for possible nuisance-producing plants it might be well to secure and publish a written opinion on the subject from the State Board of Health. While laymen may judge of the existence of a nuisance as well as experts, the probabilities can better be told by experts. The control of odors, dust, and noise affords a possible career for young engineers.

Observations of Odors in Rhode Island: Stephen DeM. Gage, Chemist and Sanitary Engineer, State Board of Health, Providence—The law does not recognize the anticipation of odors and might well be revised in this respect. The oil industries at Providence are giving out odors that affect considerable populations. Oil-burning furnaces cause complaint. The crude Mexican oil now chiefly used contains 4 per cent of sulphur before gasoline, etc., is distilled off and subsequently 6 per cent or more, oftentimes. In a community where 1,000,000 bbl. of crude oil are burned, 30,000 lb. of sulphur or 60,000 lb. of sulphur dioxide are given off. The author is not prepared to say that this is dangerous to health, but that possibility must be taken into consideration.

Some Interstate Odors: Olin H. Landreth, Consulting Engineer, New York City—Fumes from copper smelting at Ducktown, Tenn., destroyed vegetation in Georgia and led to litigation. Stipulations were entered into under which the amount of green ore treated during the growing season was restricted and damages were paid to farmers. New York State has amended its corporation laws within the last few years so as to gain some control of odors across the state line by provision for annulling charters of domestic corporations and taking away licenses of foreign corporations permitted to do business within the state.

Garbage Disposal Odors: I. S. Osborn, Consulting Engineer, Cleveland, Ohio.—The whole subject of odors has received very little study. If the amount of money spent in litigation over odors had been devoted to research much more would have been accomplished.

The nature of the business and the sort of men engaged in garbage disposal have not been such as to develop study. The chief garbage disposal odors come from the digestors, and the dryers; other garbage disposal odors can be controlled with comparative ease. Considerable of practical value may be learned from the studies of odor control at the Barren Island garbage disposal plant, New York City, made in 1915. Since then chlorine gas as a method of

controlling garbage disposal odors has been tried elsewhere, but with less success than was expected. So long as short-time contracts for garbage disposal are let, necessitating getting back the money before the contracts expire, complaints from odors may be expected. Attempt to control the production of odors by anticipation would hold back progress. The subject needs more engineering study.

General Observations: Rudolph Hering, Consulting Engineer, New York City—The subject was reviewed by me in a paper written some seven years ago. Prejudice is often the cause of complaint of odors. For instance, seeing smoke arise from an incinerator which is from a coal fire only and thus could not give any garbage disposal smell.

Studies of Odors: R. S. Weston, Consulting Engineer, Boston—Studies of odors from decomposing sugar house wastes, lactic acid manufacturing plants, and oil refineries have afforded me an opportunity for attempting to systematize the odor investigations. With the help of Wallace & Tiernan, better methods for the determination of hydrogen sulphide in air have been devised than mere smelling. We almost need a new kind of engineer—one who would take into account physiology, meteorology and chemistry, in conjunction with structural engineering—for the study of odors.

General Discussion—Alexander Potter, New York City, said that a study of odors from a trunk sewer indicated that they had their origin in lateral sewers from which they had traveled downward. Apparently the friction of the flowing sewage upon the sewer air carried the latter with it. Velocities of the sewage and air flows were measured.

* * *

Water Supply and Water Purification

History of Water Purification: George C. Whipple, Professor of Sanitary Engineering, Harvard University, Cambridge, Mass.—Fifty years ago the quality of American water supplies was low, but progress since then has been marked by the Europeap trip and water purification report of J. B. Kirkwood, 1866 and 1869; the Poughkeepsie filtration plant built after Kirkwood's design in 1872; the studies of European water treatment practice by Prof. William Ripley Nichols and his report to the Massachusetts State Board of Health in 1878, followed five years later by his pioneer book on water supply; the Lawrence experiments dating from 1887; the Lawrence water filtration plant, 1893. Also, taking up mechanical filtration, the Hyatt patents of 1884 and the first municipal mechanical filtration and coagulating plant at Somerville, N. J., in the same year—Prof. Albert R. Leeds being the real inventor; the Providence experiments of Edmund B. Weston, 1893; the Louisville experiments under the direction of Charles Hermany and George W. Fuller, 1897, followed by various later experiments at different cities; and the Little Falls filtration plant of the East Jersey Water Co., built in 1902.

Methods of testing filter performance have changed very much in the past twenty-five years. There is now more interest in what the filter actually does than in what it can do. An innovation is the determination of acidity in terms of hydrogen-ion. The B. Coli test is generally used but has its limitations. Spore formers are being considered. Typhoid fever is now so low, generally speaking, that it no longer serves as a measure of the purity of water, as M. N. Baker has pointed out.

Active and Quiet Water: Allen Hazen, Consulting Engineer, New York City—Recently a Dutch writer divided all waters into two classes, active and quiet. Active waters attack iron; quiet waters do not. The water from the Great Lakes is generally quiet, both before and after filtration; also the hard waters of the Alleghenies are generally quiet. Near the Atlantic coast the waters are soft, carry matter of vegetable origin, and are active. We need to find out how to treat these active waters without using chemicals.

Interference with Water Filtration Plant Operation by Wastes from By-Product Coke Ovens and Gas Works; C. A. Emerson, Jr., Chief Engineer, Pennsylvania Department of Health, Harrisburg—Liquid wastes from by-product coke ovens and gas plants are giving trouble in connection with many water supplies. These ovens are increasing in number. They give tastes that may travel for miles downstream and last for days. Chlorination of the waters thus affected increases the taste and odor trouble. The remedy lies within the coke oven plants. In some instances these liquid wastes have been used for coke quenching, for which purpose they are not sufficient to meet the demands. This method has silenced complaints from cities 70 miles downstream. The remedy for troubles from gas plant wastes is the use of settling and skimming basins to remove tarry matters and light floating substances. The circulation of the effluent from such basins or tanks for use in scrubbers cut down both the final volume of waste and the trouble that this sort of waste causes.

Reduction in Typhoid Death Rate (1) For the Whole Country and (2) For New York State Caused by Water Purification and Improved Supplies: Prof. C. E. A. Winslow, Professor of Public Health, Yale University, New Haven, and C. A. Holmquist, Director, Division of Sanitation, New York Department of Health, Albany—[Prof. Winslow reviewed typhoid statistics for the registration states up to 1919. Mr. Holmquist showed the great decline in typhoid since the organization of the Sanitary Engineering division of the State Department of Health in 1906 (1) for the state as a whole and (2) for a number of cities which formerly had very high typhoid but have subsequently introduced filtration. The New York State typhoid rate for 1920 was 3.5. Present indications are that the rate for 1921 will be 3.4 and possibly still lower.]

Purification of Soft, Colored Waters: Robert S. Weston, Consulting Engineer, Boston—Engineers are pretty well agreed that satisfactory water should have a color of say 10 and not to exceed 15 on the platinum scale. In the East it is generally only ground water that will comply with this standard. Slow sand filtration plants as a rule will remove say a third of the color. To do more requires chemical treatment. The latter is likely to give trouble in the case of New England waters. The subject demands more study. There is also need of consideration of the problem of after-precipitation when alum is used. Hydrogen-ion determinations are useful in this connection and not difficult.

The Operation of Reservoirs for Water Supply: Samuel A. Greeley, Hydraulic and Sanitary Engineer, Chicago—Storage of water in the upper Mississippi Valley is generally costly. The water in this section is generally so turbid as to require filtration and this gives rise to greater toleration for possible pollution. The relative scarcity of natural reservoirs and lakes in a considerable portion of the Middle West creates a great demand for the use of such bodies of water for recreation purposes. The use of such reservoirs for bathing is the most serious of the various uses. The provision of special bathing pools affords relief from this danger.

* * *

Sanitary Engineering Section

Proper Size of Sand for Rapid Sand Filters: W. H. Dittoe, Chief Engineer, Ohio State Department of Health, Columbus—During the past five years studies have been made of fifty rapid sand filter plants in Ohio. The larger of the plants are in charge of trained men, fifteen of whom may be classed as experts. General conclusions reached by the State Department of Health are: (1) Final product from filters should be free from gas formation in 10 c.c. after 24 hr. incubation at 37 deg. Fahr. in lactose broth. (2) Filtration plants should be so designed and constructed as to give no serious operating difficulties. (3) Purification works should be operated so each part will do its proper work without any overloading and so that disinfection should be used as a factor of safety only.

The study of these Ohio plants indicates that those having filter sand of an effective size of 0.6 m.m. or more are not producing satisfactory effluents, while an effective size of 0.45 give a high degree of purity, with no need for disinfection except as a factor of safety.

The conclusion has been reached that hereafter all new filters should be provided with fine sand and that all old ones having coarse sand should have the sand replaced with fine as soon as may be, this sand to have an effective size

of from 0.35 to 0.42 m.m. and a uniformity coefficient of 1.8. The preference is for an effective size of 0.37 m.m. and a uniformity coefficient of 1.6, with all sand particles less than 1 m.m. in size. For the past two years all new plants have conformed to these specifications as well as all substitutions of sand in old plants. A layer of "torpedo" sand is placed between the main sand bed and the gravel.

General Discussion—F. A. Dallyn, Toronto, Ont., favored finer sand, but said that in Canada this greatly increased the cost of filters because fine sand had to be imported from America; consequently, coarser local sand is now permitted. At Toronto, $35,000 a year can be saved by using less alum and allowing some turbidity. Why should not this be done if it has no effect upon increase of typhoid?—[as Mr. Dallyn evidently believes.] Robert Spurr Weston, Boston, voiced agreement with the principle of fine sand, and said he would like even smaller sand than Mr. Dittoe had specified, but remarked that fine sand consolidates in sections. Allen Hazen, New York City, said that fine sand works to one side and coarse sand to the other side of the filters. C. M. Baker, Lansing, Mich., spoke of fine sand rising to the top of the filters. C. A. Emerson, Jr., Harrisburg, Pa., questioned whether state boards of health should not confine their action more to judicial functions than they do and expressed the belief that they had gone too far in performing the function of consulting engineers.

Industrial Wastes in Relation to Water Supplies; Wellington Donaldson, Sanitary Engineer, New York City—In general any burden of industrial wastes on water filters effects health in some way, as where these wastes cause taste from chlorine, leading consumers to resort to well waters or bottled waters that may not be safe. Of more importance are wastes that interfere with filter operation, as oil, which coats the sand, or wastes that affect coagulation, or others which lessen the action of chlorination.

Centrifuges for Sludge Dewatering: T. Chalkley Hatton—Reserved for separate presentation.

The Chemical and Biological Reaction of the Dorr-Peck Activated-Sludge Tank: A. M. Buswell, Chief, Illinois Water Survey, Urbana—[Chiefly a description, with an account of the results, of the Champaign experimental plant.] at Champaign, Ill.

General Discussion—John F. Skinner, Rochester, N. Y., told of the low cost of operating the sludge drying beds that take Imhoff tank sludge at Rochester, N. Y. He seemed to think it would be difficult to meet these figures with centrifuges, taking both capital charges and operating expense into account. R. H. Eagles, New York City, spoke of the use of sulphuric acid on the one hand, and on the other of sulphur dioxide and live steam for sludge treatment. Kenneth Allen, New York City, said that a centrifuge he saw some years ago worked well and that there had been an improvement since—referring to the earlier and the later and modified Ter Meer centrifuge. He thought there was a field for the use of centrifuges on plain sludge, but the chances are not so good for successful use on activated sludge, besides while Imhoff sludge can be readily dried on beds.

Dr. Edward Andern, consulting engineer, Manchester Sewage-Works, England, opened some brief remarks by saying that he was visiting this country on a voyage of discovery—with special reference to activated-sludge plants. He did not think that circular tanks were as well adapted as rectangular to the activated-sludge process because with circular tanks it was almost impossible to avoid short circuiting. He saw very little advantage in the Dorr-Peck activated-sludge tank over tanks of plain construction. In England, Dr. Ardern said, both air and mechanical agitation are being used for activation purposes. He thought that within twelve months there should be some knowledge of which of the two is best. Dr. Ardern agreed in general with Mr. Hatton's remarks on the sludge problem, but not with Mr. Hatton's sweeping conclusion that sludge disposal in England is inefficient, and apparently not wholly as to the likelihood of getting fertilizing value from sewage sludge in general. Dr. Ardern stated that in England the agricultural chemists, years ago, had satisfied themselves that ordinary sewage sludge had low fertilizing value, besides which the grease in the sludge gives trouble when the sludge is applied to land. The sludge from the activated-sludge process is more promising. The Board of Agriculture of England has engaged Dr. Russell, a leading agricultural chemist, to investigate activated-sludge possibilities.

F. A. Dallyn, Toronto, expressed himself as being very hopeful as to the prospect of getting fertilizing value from activated sludge.

Mr. Hatton said he wished to take issue with Dr. Ardern as to ordinary sludge not yielding sufficient fertilizer value to make it practicable. In support of this he cited experiences at Baltimore. Mr. Hatton also said that as far as activated sludge is concerned he had proposals on his desk from four companies to take all the sludge produced at Milwaukee. F. W. Mohlman, of the Chicago Sanitary District, said that parallel tests of a Dorr-Peck tank at Chicago and an ordinary activated-sludge tank followed by sedimentation in a tank with the Dorr thickener, showed about the same detention period and air demand for each type.

Connecticut Stream Pollution Studies: J. Frederick Jackson, Engineer, State Department of Health, Hartford—[Under the title "Correlation of Stream Pollution Criteria from Studies of Naugatuck and Hockanum Rivers" the author pointed out, among other things, that the dilution ratio in terms of stream flow to population as ordinarily considered does not govern on these streams, partly on account of industrial wastes.]

Sanitation of Public Bathing Waters: Committee Report and Papers—For the Committee on Bathing Places, George W. Simons, Jr., chairman, Jacksonville, Fla., reported the results of a canvass of physicians and health officers to ascertain (1) their opinions and (2) their observations on the transmission of specific diseases by the use of swimming pools and other public bathing places. A long list of infections was covered. Many of the replies were in the affirmative as to possibilities and also as to observed cases, the latter being fewer than the former. Under typhoid and paratyphoid, 155 replied that in their opinion bathing places are means of spreading these diseases while 18 reported actual cases believed to have been contracted in public bathing plcs. S. DeM. Gage and A. E. Griffen, Providence, R. I., presented a score card for rating the sanitary quality of bath-houses and public bathing places. W. F. Walker, Detroit, recounted favorable observations on ultra-violet rays for the disinfection of swimming pool water.

Garbage and Refuse Disposal—M. N. Baker, New York City, chairman of the committee on this subject, reviewed the generally unstable conditions prevailing in this field; commented on the relatively few engineers engaged in garbage disposal engineering, and suggested that it be taken up by more; and raised a question as to the desirability of having plans for garbage and refuse disposal plants submitted to state departments of health for approval. E. A. Fisher, Rochester, N. Y., described the new Cobwell garbage reduction plant in that city. Dr. J. D. Robertson, commissioner of health of Chicago, said he thought it was now generally considered by health authorities that garbage disposal is not much of a health question. C. M. Baker, Lansing, Mich., and F. A. Dallyn, Toronto, Ont., stated that their respective state and provincial boards of health pass upon plans for garbage disposal.

Milk Pasteurization—H. A. Whittaker, Minneapolis, chairman of the Committee on Milk Supply, reported that pasteurization in relation to the cream line had been the subject of study for the year. Dr. H. D. Pease, New York City, read a paper summarizing the results of studies by himself, S. M. Heulings and E. C. Towne on the physical effects of pasteurization on milk.

Mosquito Extermination—A review of this subject was presented by W. D. Becker, supervisor of sanitation, Philadelphia Department of Health.

Health Value of Zoning—Charles B. Ball, chief sanitary inspector of the Chicago Department of Health, made a strong plea, illustrated by well chosen lantern slides, for the beneficial effects of zoning upon health. He stated that the *National Real Estate Journal* for Nov. 7, 1921, contained a list of 44 cities that have already passed zoning ordinances and 76 more that are now working on the problem.

LETTERS TO THE EDITOR

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

In Support of Corps of Engineers

Sir—The editorial "Overemphasizing the Corps of Engineers" in your issue of Oct. 6, and subsequent letters are of much interest to former engineer officers. Just as the reputation of any school is made by its graduates so, it seems to me, should the ability of the Corps of Engineers to perform its duties in war be the measure of the soundness of the present method of training the Corps. By giving it, in times of peace the handling of much property, machinery and men, with adequate responsibility and authority and with the constant inculcation of the traditional spirit of the Corps, it was enabled to fully meet its test in the late war.

Great engineering achievements that have not a permanent physical monument such as the Panama Canal are apt to be quickly forgotten; but surely the engineering profession should not forget but should take pride in the expansion of the handful of engineer officers and the few battalions of engineer troops which existed before the war into an aggressive working force of 175,000 officers and men in France alone. They were equal to any task assigned them, including combat work and all construction for all branches of the service. This force was organized and directed by regular officers of the Corps of Engineers and while I hold no brief for them, I am willing to certify to their ability and to the soundness of their training.

I saw service in France as engineer officer in charge of construction and later for many months I served in Tours under the Director of Construction and Forestry, Brig.-Gen. Edgar Jadwin, who with his deputy, Col. J. A. Woodruff, were both regular army officers. Those two officers, with their civilian officer assistants, managed the personnel, generally directed the policies and work and obtained materials for over 150,000 men with an efficiency that produced results and contributed powerfully to the winning of the war. This I submit is an achievement that has not been paralleled within our time. It was done by a system of decentralization that gave engineer officers in charge of projects an opportunity to produce results limited only by their individual abilities.

All of us would do well to emulate many of the qualities of the Corps of Engineers, particularly the industry, high-mindedness and devotion to duty of its officers. It is a branch of service in which all Americans should take pride and anything which would curtail its training or lower its morale would be deplorable and not for the good of the country. The wisdom of continuing its present functions is evident and should need no defense.

Houston, Tex. JOHN LANSDALE,
Nov. 16. Valuation Engineer, Southern Pacific Lines; formerly major, Engineers, A. E. F.

Against Rod Soundings

Sir—I notice in your issue of Sept. 29, p. 539, a brief article by George E. Horr entitled "Determining Character of Subsoil with Sounding Rods." I am surprised to read his criticism of the wash boring. If Mr. Horr knows of one instance when the geological conditions were reported incorrectly, how many does he know that proved otherwise?

I disagree also with his recommendation as to the efficiency of rod soundings, even as a preliminary. This method of procedure, in my opinion, is a waste of time and money in ascertaining with any degree of certainty the depths required for a pile of rock foundations. By this method it is impossible to estimate the skin friction or the sustaining loads of a pile in the various strata encountered, for a small stone or boulder driven ahead of the rod gives a false resistance. Having no samples or water levels the contractor after figuring safely on the indefinite information furnished is liable to add 10 to 25% of his estimate for contingencies, thereby increasing the cost to the owner ten to twenty-five times the cost of making proper foundation test borings. A few hundred dollars spent in making borings, either wash, auger or core borings if necessary, ensures positive information and saves thousands of dollars in contingencies and extras.

Because of the lack of information as to the intervening strata between surface and a suitable hard bottom or information regarding water levels, the information from rod soundings is so unreliable that building department permits should not be issued upon such soundings.

SAMUEL WORTHINGTON,
Phillips & Worthington
New York City, (Foundation Test Borings, Wells
Oct. 3, 1921 and General Prospecting)

Water Meters Help Give Maximum Service

Sir—In addition to your commendable answer in *Engineering News-Record* of Oct. 27, p. 702, to the contributor from Fresno who has attempted to justify flat water rates permit me to add the following: Is not the water meter like an insurance policy and the Liberty Bonds we all possess, in that they compel people to save? Do we neglect our personal appearance and the painting of our homes, etc., because we must economize for those investments?

The layman and the public in general are inclined to draw the conclusion that the introduction of meters is prompted by the desire of the water company to increase its earnings. The policy of the water company is to give the maximum amount of service for a minimum of charge and it can do this only if its facilities are used economically. If it must lay larger mains and build more pumping stations to supply water to be wasted that the company must receive a greater return in earnings than would otherwise be necessary. This must be fundamentally true and applies not only to privately owned utilities but also to those operated by municipalities.

San Francisco, Cal., Nov. 14. GEORGE H. BRAGG,
Pacific Gas & Electric Co.

Would Tax Trucks on Mileage Basis

Sir—In riding around Massachusetts, on its beautiful state highways, I am impressed with two things: (1) That trucks should pay a fee for inter-town trips. (2) That trucks should be definitely limited as to width of body.

With reference to a definite system of fees, I believe that a charge of $0.10 per mile for a single trip for a loaded truck is not unreasonable. For a 5-ton truck, loaded on a 50-mile trip, the customer pays $1 per mile, or $50. A fee of $5 extra would certainly not be objectionable to him. In this way, definite compensation would be paid for the serious damage which most trucks inflict on the roads. Also, trucks would thereby pay a larger percentage of the highway construction costs than now. At present the pleasure car pays for almost the whole cost, and has the road destroyed to a great extent by the trucks, and blocked and made almost impassable at times.

Of course, our Massachusetts State Highway Department is more than self-supporting, but I feel that trucks are not paying for their share of the benefits received.

Boston, Oct. 24. L. F. BUFF,
Buff & Buff Manufacturing Co.

Tatoosh Peak Named For Lane

The U. S. Geographic Board at a recent meeting named one of the loftiest peaks in the Tatoosh Range within Mount Rainier National Park in memory of the late Franklin K. Lane, former Secretary of the Department of the Interior. The peak has an altitude of 6,000 ft. and is located near Cliff Lake, Pierce Co., Wash.

HINTS FOR THE CONTRACTOR

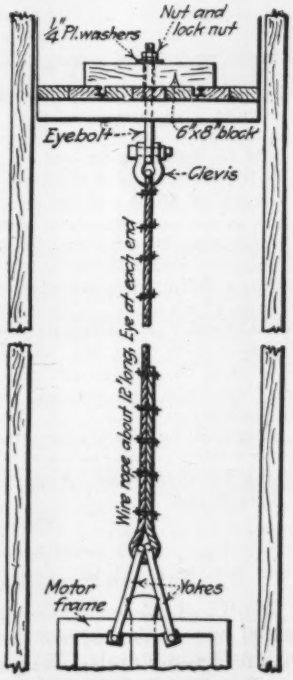
Breaking Up 30-Year-Old Brick Tunnel Found Difficult Task

AFTER 30-years' service a portion of the Van Buren St. brick tunnel of the Chicago Surface Lines under the Chicago River has recently been lowered so as to pass under the tracks of the new Union Station. The brick and hydraulic cement were found in such an excellent state of preservation that a steam shovel could not pick holes in the 2½ ft. tunnel roof of seven rows of brick. A 1½-ton iron ball, used to break up scrap iron, made little headway until an opening had been made by blasting. To bring the work down to an even grade points and sledge hammers were used, taking out a brick at a time. Samuel G. Artingstall was engineer in charge of the original work which was carried out by Joseph Downey, contractor.

Mine Locomotive Lowered Through Shaft By Novel Method

BY B. G. BEST
Civil and Mining Engineer, Ironwood, Mich.

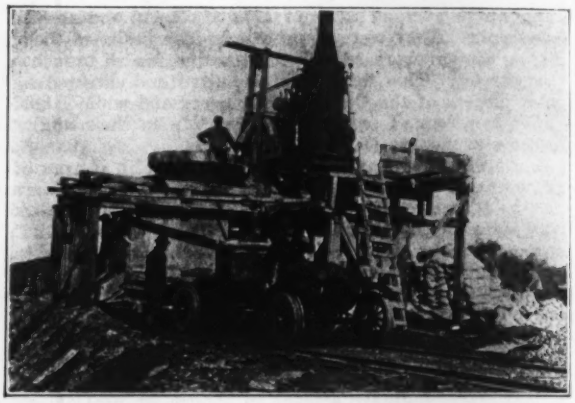
WHERE small locomotives have to be lowered through shafts for tunneling or other underground operations the method used in northern Michigan iron mines and described here is useful. The motor is placed on surface tracks a short distance from the shaft and all removable parts are taken off and lowered on the cage. A rope is then fastened to the rear coupler and snubbed around a post or deadman. A 1½-in. eye-bolt is now passed through a hole in the center of the floors of the cage, through a 6 x 8 in. block laid across the rails and secured by nuts and washers as shown. A piece of hoisting rope, about 12 ft. long and with and eye in each end is attached to the eye-bolt by a clevis made of 2-in. steel. The cage is hoisted a few feet above the collar of the shaft and two yokes of 1½-in. rods are passed through the lower eye of the hoisting rope. The yokes are then placed around the front end of the frame of the motor and the bolts inserted. The cage is slowly hoisted and the motor swung into the shaft, being held back by the rope attached to the rear coupler and the clevis being turned until the motor hangs square in the shaft. The tail rope is pulled taut and made fast to the upper end of the eye-bolt. The cage is lowered until the motor has reached the level where it is be used. The tail rope is then loosened and pulled out on the level. If the track underground is on the same side of the shaft as that on surface it is necessary to turn the motor around, so that when landed it will be right side up. This is done by turning the clevis. The lower end of the motor is pulled out on the level, either by hand, with block and tackle, or by a second motor, the cage being lowered at the same time.



ATTACHMENT TO SHAFT CAGE FOR LOWERING LOCOMOTIVE

Ford Trucks With Flanged Tires Haul Concrete Cars

ON SEWER work at Syracuse, N. Y., this season, wet batches were hauled from a central mixing plant by Ford trucks equipped with flanged tires to travel on railway track. The sewer, 7½ x 7 ft., of reinforced concrete, is 4,500 ft. long. The central mixing plant was erected about 300 ft. from one end and consists of a one-bag mixer, on a framework 12 ft. high, charged by an elevating skip on extension leads, and discharging into a 2-cu.yd. bottom gate hopper. A single car with a 2-cu.yd. side-door body, hauled by two Ford trucks on standard-gage track, handled the wet batches. It was found that two trucks, facing in opposite directions with the car between them, were more satisfactory than one on account of the low reverse gear of the Ford truck. One truck hauls the car out and the other brings it in. The flanged wheels designed by the contractor are single castings, which bolt to the truck wheel. John Young, Syracuse, N. Y., is the contractor.



FORD TRUCKS HAUL CARS ON STANDARD-GAGE TRACK

Standard Gage for Australian Railways

For a unification of gage on Australian railways the standard gage of 4 ft. 8½ inches has been recommended by a commission appointed by the Federal government of Australia. In view of the great cost of complete unification, said to be estimated at nearly $350,000,000, it is proposed to limit the work at first to the main lines at an estimated cost of $75,000,000.

NEWS OF THE WEEK

New York, December 1, 1921

Hoover Endorses Trade Association Idea

Needed in Our Economic System, He Says, Although A Few of Them Merit Censure

(Washington Correspondence)

Despite the criticisms that have been heaped upon the trade associations and the disinclination on the part of the Department of Justice to attempt to clarify the situation prior to the decision of the Supreme Court in the hardwood lumber case, the U. S. Department of Commerce is actively championing the trade association idea. Secretary Hoover and members of his staff are taking pains in their utterances to show that the questionable conduct of a few trade associations, or aggregations calling themselves trade associations, has resulted in uncharitable criticism of all trade organizations. Mr. Hoover has expressed himself so definitely on the subject that there can be no doubt that he believes trade associations are necessary to the maximum progress of industry. The rapid multiplication of trade associations until they number nearly 3,000 is interpreted by Mr. Hoover to indicate "a great and vital movement and something permanent in our economic system." Other quotations from Mr. Hoover on the subject follow:

CO-OPERATION IN BUSINESS NEEDED

"The coming together of manufacturers and producers in the different trades for the purpose of the advancement of their industries as a whole is a profound step toward co-operation in the whole business world. Out of it will be gained tremendous benefits for the business public. The various trade associations present a point of contact with the government such as did not exist ten years ago.

"I know of no way in which we can undertake the solution of collective questions except by the cooperative organization of the men in the industry. We cannot go on maintaining our standard of living in the face of the foreign competition that we have in front of us, unless we can make some progress in the collective sense. The only way that we can hope for it is through the organization of associations that will take up the problems common to all, that gain inch by inch the efficiency and stability that make for national efficiency."

F. M. Feiker, assistant to the Secretary of Commerce said recently:

"The trade association is the natural organization functioning in the establishment of contacts between the government and industry. They are indispensable in such matters as the collection of statistics, the detailed promotion of foreign trade and in the elimination of excess variety. It is the only avenue that the Department of Commerce sees by which the government can establish contact with a trade to the mutual advancement of fundamental interests."

Am. Soc. C. E. to File Professional Records of Its Members

In accordance with a decision by the Board of Direction on Oct. 11, the American Society of Civil Engineers is sending to its members blank forms on which space is provided for a biographical and professional record. These blanks, when filled in, are to be kept at society headquarters in New York and will be available to all inquiries. Each member has the privilege of keeping his record up to date.

Survey Ordered for Market St. Subway in San Francisco

At the Nov. 21 meeting of the San Francisco Board of Supervisors the city engineer was ordered to study and make plans for a 4-track subway under Market St. from the Ferry to Valencia St., a distance of about 2¼ miles.

This was proposed as a means of relieving the increasing congestion of this important thoroughfare and making its entire width through the business district available for vehicular and pedestrian traffic. The proponent of the measure said he did not anticipate immediate construction, but thought that a start should be made on such a project.

Power Commission To Consider St. Paul High Dam

The Federal Power Commission probably will consider at its next meeting the "high dam" project between St. Paul and Minneapolis. It is apparent that the Northern States Power Co. could utilize this power to greatest advantage, but the matter is complicated by a determined protest from Senator Nelson of Minnesota who wants to see this development handled by a municipal corporation formed ten years ago under a special act of the Minnesota Legislature. This corporation is composed of the City of St. Paul, the City of Minneapolis and the University of Minnesota. In addition, the City of St. Paul is endeavoring to secure sole control of the water power.

Senator Nelson's main objection seems to be based on the allegation that the Northern States Power Co. is a monopoly and that to give it jurisdiction over this additional power would add to the monopoly, although there seems to be little question that the public utility company is the only applicant in a position to get maximum utilization of the power available.

The municipal corporation has been in existence since 1911 and has done nothing toward developing the project. The application of St. Paul is regarded in some quarters as in fact an application of Henry Ford, as it is understood that he is to have first call on the power if the city should be given the permission to develop it.

Big Demand for Exhibit Space at Road Show

Plan to Lease Armory and Other Buildings in Addition to Chicago Coliseum

All records for the amount of space sought by exhibitors of highway construction equipment and materials at the forthcoming Good Roads Show, to be held in the Coliseum, Chicago, Jan. 17-20, in connection with the convention of the American Road Builders Association will be broken this year. On Nov. 23, 86 exhibiters had contracted for all the space originally provided in the Coliseum, and Annex, and plans are now being considered for the leasing of a nearby armory and other buildings to accommodate manufacturers who wish to display their products at the show.

The first plans of those in charge of the exhibit provided for about 40,000 sq.ft. of space, but according to present estimates the amount will have to be increased to at least 60,000 sq.ft. This year exhibitors are demanding a larger area for the display of their products than was the case at last year's show. The recent passage of the Federal-Aid Highway Act, it is believed, has made certain a record-breaking highway construction program for 1922 and manufacturers apparently anticipate that the engineers and contractors attending the annual convention of the American Road Builders' Association will display keen interest in their products.

The subject of highway transport is to be featured at the convention and it is noteworthy that at this year's show more motor truck exhibitors will be represented than ever before. The U. S. Bureau of Public Roads will have an elaborate exhibit occupying about 2,000 sq.ft. of space. At the present writing there is a waiting list of 50 prospective exhibitors not yet provided for.

Commerce Department Collects Construction Data

Among the recently inaugurated activities of the Division of Building and Housing of the U. S. Department of Commerce are the collection from contractors and secretaries of building exchanges of building material prices actually paid by contractors. Information has been obtained for several months and has been distributed among those who have supplied the information.

The division, which is under the direction of John M. Gries as chief, is also obtaining from the contractors data on the percentage of different materials and the amount of labor that go into a typical six-room frame and a six-room brick residence. This survey will enable some estimate to be made of the importance of price fluctuations in labor and in different classes of materials entering into these types of dwellings.

Ohio River Bridge To Be Double-Tracked

Illinois Central R.R. Authorized to Replace Single-Track Structure at Cairo, Ill.

Authority for replacement of the single-track bridge of the Illinois Central R.R. over the Ohio River at Cairo, Ill., by a double-track bridge on the present stone piers to cost about $8,500,000 was granted Nov. 2 to the railroad by the Secretary of War. The permit provides for beginning work in one year and completing it within three years. The present bridge, built in 1887-88, consists of two through-truss spans of 523½ ft., seven of 405 ft., and three deck-truss spans of 250 ft. The new bridge is to have the same headroom under the channel spans at high water as the present.

On the Illinois side the former structural approach has been filled, leaving only a 50-ft. deck-girder span, but the Kentucky approach has 21 deck-truss spans of 150 ft. and one 106-ft. deck-girder span, all on steel cylinder piers filled with concrete. It is proposed to increase the dimensions of the river piers from 43 ft. to 52 ft. length and from 14 ft. to 17.75 ft. width at the top by rebuilding the upper portion, the work to begin at the starling or middle belt course and the increased size to be obtained by a reduction in the batter.

Similar Proposal Rejected

A similar proposition was made by the railroad company a few years ago, but was rejected by the War Department on the ground that navigation interests claimed that a channel span of 800 to 1,000 ft. was needed for the safe passage of large tows of coal barges. As the company was not willing to undertake such expensive reconstruction the matter was dropped. During 1914-1915, however, the superstructure was strengthened sufficiently to enable it to carry heavier loading, as described in *Engineering News-Record* of March 9, 1916, p. 448.

Since the railroad traffic is approaching the capacity limit of the single-track structure the project for double-tracking was revived. The character of the river traffic has greatly changed. The large tows or fleets of coal barges are no longer operated and the river conditions do not now justify the claims for such long spans as were demanded when the former request was made. On the basis of 1919-20 prices the cost was estimated at $8,482,000, as against $10,752,000 for a new bridge with a 700-ft. channel span.

Wenatchee Reclamation Project To Cost $5,000,000

One of the largest reclamation projects ever undertaken in the State of Washington is being planned for the Wenatchee and Columbia River valleys, in which more than 46,000 acres of fruit and farm lands will be reclaimed. The Greater Wenatchee Irrigation Association, of which F. W. Schultz, banker of Wenatchee, is president, will have charge of the work. The total cost of completing the project has been estimated at $4,500,000 to $5,000,000.

Ontario Hydro-Electric Current May Light Detroit

At the recent November election the voters of Detroit, Mich., adopted a charter amendment which permits the Public Lighting Commission, subject to the approval of the city council, to make a ten-year contract with the Ontario Hydro-Electric Commission for current from Niagara Falls. Such current is already being used directly across the border in Windsor, Ont. If the plan is adopted it will obviate the necessity of the $5,000,000 power house proposed by the Detroit Public Lighting Commission.

Big N. Y. Subway Contract Awarded

The New York Transit Commission last week awarded to the Powers-Kennedy Contracting Corp., 149 Broadway, New York City, the low bidder, the contract for the extension of the Queensboro route of the duel subway system from Grand Central Station under 42nd St. and Bryant Park to 8th Ave. The amount of the bid was $3,867,138.

Hudson Vehicle Tunnel's Status Still Unchanged

The situation with regard to the Hudson River vehicular tunnel, which has been deadlocked for months due to disagreements between the New York and the New Jersey commissions, may be summed up as follows:

Both commissions have approved an agreement with the Erie R.R. involving the site of the ventilating shafts on the Jersey side, but at this writing the railway's representatives have not signed the document. This matter constituted one of the big differences between the two commissions due to the insistence, by the Jersey members, of perpetual rights for a railroad siding along the tunnel plaza. In the agreement, as now approved, no reference to the siding is made.

All bids for the construction of the Jersey shafts, received recently, have been rejected and the plan now is to include the Jersey shafts in the main tunnel contract.

Clifford M. Holland, chief engineer, has been authorized to have printed the contract and specifications for the under-river tunnel, the main portion of the project. If no hitch occurs, it is expected that a call for bids on the big subaqueous tunnel contract will be made during the latter part of December.

The board of consulting engineers, which was summarily "dismissed" last summer by the New Jersey commission, without the concurrence of the New York commission, has served a writ of mandamus on the New Jersey commission demanding their pay for the period May 14 to date. Each consulting engineer had been retained at a yearly rate of $10,000 and payment has been held up by the New Jersey body, which subsequently appointed two "technical advisers" in place of the consulting board. It is understood that the Supreme Court of New Jersey has set Dec. 28 for a hearing on the case of the "dismissed" consulting engineers.

Cities on East Side San Francisco Bay Reject Consolidation

By a vote of 29,480 to 20,070, the ten municipalities of Alameda County, Cal., on Nov. 15 rejected the proposal for a consolidation of city and county governments. The Oakland vote was 16,000 for and 12,000 against, while all the other municipalities also voted against the measure. The Oakland balloting was light, only 29,000 out of 88,000 registered voters going to the polls. The vote from other parts of the county was the largest ever cast.

The proposed consolidation would have been under a new charter that provided for a city and county manager to be paid $12,000 a year with seven councilmen receiving $3,000 per year each.

Object to Kendrick's Dismissal

Members of local engineering organizations, including the American Association of Engineers, the Alabama Technical Association, and the American Society of Mechanical Engineers, are objecting to the recent dismissal of Julian W. Kendrick as city engineer of Birmingham, Ala. Mr. Kendrick was replaced by the new city admistration, which took office Nov. 7 and appointed A. F. Hawkins as Mr. Kendrick's successor. Mr. Kendrick had served as city engineer for 30 years.

The board of commissioners of Birmingham has received a resolution from the three engineering societies above named protesting against their action in dispensing with the services of the former city engineer and demanding public announcement of the reasons for the commission's action.

To Consider Rules for Tunnel and Compressed Air Work

The Industrial Board of the New York State Department of Labor has scheduled hearings on proposed rules relating to tunnel construction and work in compressed air, to be held at Buffalo (Iroquois Building) Dec. 12; at Rochester (Melbach Building) Dec. 14; at Syracuse (Onondaga County Court House) Dec. 16; and in New York City (Department of Labor headquarters) Dec. 20. Copies of the proposed rules may be secured from the Division of Industrial Codes, 124 East 28th St., New York City.

TABLE I—PROPOSED WORKING PERIODS IN COMPRESSED AIR IN NEW YORK

Air Pressure, Lb. per Sq.In.	Total Length of Working Period, Hours	Number of Periods in Compressed Air	Length of Each Period, Hours	Rest Interval Between Work Periods, Hours
0–21	8	2	...	...
21–30	6	2	3	1
30–35	4	2	2	2
35–40	3	2	1½	3
40–45	2	2	1	4
45–50	1½	2	¾	5

The proposed hours of labor in compressed air are indicated in Table 1. Other features of the rules relate to permissible periods of decompression, wash and rest rooms, sanitation and ventilation, medical attendance, and other subjects. Rules covering the transportation, storage and use of explosives are set forth in considerable detail.

Kentucky Highway Department To Decentralize Activities

The State Highway Department of Kentucky, according to information received from Commissioner Joe S. Boggs, will reduce the number of its division engineers on Jan. 1 from 9 to 6, thereby increasing the size of the districts. An assistant division engineer and the necessary clerical help will be furnished to each division and many matters of detail that are now handled by the central office will be disposed of at division headquarters.

The work of the department, Commissioner Boggs points out, has so grown in the past two years that it is now necessary for the central office be made purely an administrative office and for most all detail work to be handled in the divisions. Under the new plan it is believed that the department will function much better than at present.

Water and Other Bond Issues Beaten at Kansas City, Mo.

An $11,000,000 bond issue for waterworks improvements at Kansas City, Mo., and 17 other bond items were defeated in an election at Kansas City, Mo., Nov. 22, but while there were actual majorities against each of the miscellaneous items (bridges, sewers, paving, etc.) the water bond vote was 19,028 for to 12,350 against, the defeat being due to a two-thirds majority requirement. Charter amendments for creating a bi-partisan water commission and for the sale of the water bonds (if voted) were carried by large actual majorities. Another vote on the water bonds is predicted, perhaps on January 31, when it is hoped that they will be authorized, particularly now that provision has been made for a bi-partisan water commission.

To Speed Public Works Program

Mayor Benjamin Bosse of Evansville, Ind., at a recent meeting with a committee he appointed to devise ways and means of providing work for unemployed men in that city, said he would speed up his public improvement program for the next four years in order to give work to the idle men. His idea was to have the work that he had mapped out for the next four years done in two years.

Contractor Pours Seat Concrete in Ohio Stadium

Foundation work for the big stadium of the Ohio State University at Columbus has been practically completed by the E. H. Latham Co., the contractor, and in the western leg of the structure the reinforced-concrete seat-bank construction of the inner section is being poured. The stadium is in the form of a horseshoe. It will seat 63,000 spectators. Its main portion consists of steel frame and reinforced-concrete seating slab, but the inner portion is wholly of concrete. The broad lower tier, 148 ft. wide, will have fifty-four rows of seats. Above will be a narrower second tier.

Although the original working schedule of the contractor, drawn up at the time work began, last July, did not contemplate pouring any seat-slab concrete until next spring, such progress has been made that a large part of the inner section will be in place by winter. Steel erection and form construction will go on during the winter and all the concrete work will be completed next summer. It is expected that the first football game in the new stadium will be played during the 1922 season. The structure will require 4,300 tons of steel and about 4,500 cu.yd. of concrete. Its total cost will be $1,341,000 as fixed maximum, with profit sharing for reduction of cost below this amount.

CONSTRUCTING OHIO STATE UNIVERSITY STADIUM TO SEAT 63,000

Engineer to Help Revise Charter of New York City

Among the members of the New York City Charter Revision Commission announced Nov. 28 by Gov. Miller are William Barclay Parsons, formerly chief engineer of the Rapid Transit Commission of New York City; Edward M. Bassett, a member of the recent Public Service Commission, First District, and chairman of the recent heights of Buildings and Zoning Commission; Francis M. Scott, a former corporation counsel of New York City and once a member of the Aqueduct Commission, who is named as chairman; Howard Lee McBain, professor of administrative law at Columbia University; and Herman A. Metz, formerly city controller. Under the legislative act creating the commission, the mayor, city controller, a borough president and the president of the board of aldermen are also members of the commission.

Advance Planning of Public Works Is Proposed

Senate Bill Aims to Provide Relief For Unemployment in Times of Depression

In order to carry out the policy recommended by the President's Conference on Unemployment at Washington, D. C., and to prepare against future periods of business depression and unemployment, a bill involving the long-range planning of public works was introduced last week into the Senate. The bill contemplates the allocation of public works construction over a period of years which shall provide employment in times of depression. It has in view that the prosecution of public works be utilized as a stabilizing force during a period of over-expansion as well as during a period of depression.

As a means of granting authority necessary to carry out such a policy, the bill provides that the head of each executive department be authorized to prepare and to revise periodically the necessary plans for public works and projects within his jurisdiction. From such information and from information furnished by the Department of Commerce as to the trend of business conditions, it is believed possible to forecast in a general way business conditions so that the allocation of public works in times of depression may serve to relieve unemployment stress.

The total value of all public works in the United States by all governmental agencies, without considering those public works paid for by current taxation, is estimated at $825,000,000 annually. If a national policy were adopted of expanding public works in years of depression and contracting public works during the other years, it is believed that there would be executed three times the average in a year of unemployment, inasmuch as such a period of stress is not likely to occur very often. Under such conditions it is estimated that approximately $2,500,000,000 would be available for public works construction in a bad year.

Funds Available to Hetch Hetchy Mountain Division

The date of expiration on an option covering $8,520,000 of San Francisco's Hetch Hetchy Water Supply bonds, held by the Construction company of North America, has been extended from November 1 to February 15. The construction company, which holds the contract for the tunnel work on this project has already purchased more than $13,000,000 worth of these bonds.

Funds are now available for completing the mountain division of this project which includes the Hetch Hetchy dam, 18 miles of tunnel, and the forebay, penstock and equipment for the development of 66,000 hp. at Moccasin Creek. The $8,520,000 block of bonds under action is expected to supply funds with part of which can be built that portion of the aqueduct between Niles and Crystal Springs. This is the part of the Hetch Hetchy system which it is proposed that the city and the Spring Valley Water Co. use jointly according to a plan recently outlined by the California Railroad Commission (*Engineering News-Record*, Sept. 15, 1921, p. 463).

Prof. Geffcott Is New Secretary of British Civil Engineers

Prof. Henry H. Geffcott, the recently appointed successor to Dr. J. H. T. Tudsbery as secretary of the Institution of Civil Engineers, London, has sent the following reply to congratulatory letter received from Elbert M. Chandler, acting secretary of the American Society of Civil Engineers:

"I thank you most warmly for your kind letter of congratulations and good wishes to me on my appointment to the secretaryship of the Institution of Civil Engineers.

"I look forward with much pleasure to my new work. I need hardly say I heartily reciprocate your wishes for cordial co-operation between our institutions and I trust that our work may be mutually helpful in the interests of our common profession."

Pouring 1,000 Cu.Yd. Per Shift in Hetch Hetchy Dam

The first concrete in the Hetch Hetchy dam which is being built as a part of the new water-supply system for San Francisco, was poured late in August and on Nov. 18 a total of 53,000 cu.yd. had been placed. The maximum pour in 8 hr. was 1,239 cu.yd. and during the first 18 days of November six 8-hour shifts placed more than 1,000 cu.yd. each. Only one 8-hour shift is being worked per day at present.

The present contract is for carrying the dam up to a height of 342 ft. above the lowest foundation. This will involve a total of 365,000 cu.yd. of concrete and is to be completed before Feb. 1, 1923, which will be in time to store the 1923 summer runoff. A general description of the foundation work and preparation for construction of the dam appeared in *Engineering News-Record*, Aug. 11, p. 222.

Sell $8,520,000 Block of Hetch Hetchy Water Bonds

The last of all the bonds that have been issued to date by San Francisco for the construction of the Hetch Hetchy water supply project were sold Nov. 15 in an $8,520,000 block which was unexpectedly taken up by the same syndicate of bankers which two months ago purchased a $13,500,000 issue of these securities. This syndicate is acting in conjunction with the Construction Company of North America which has the contract on the 18-mile tunnel. The total amount of Hetch Hetchy bonds issued to date is $45,000,000.

The $8,520,000 block just sold bears interest at 5½ per cent and was bought at par. The proceeds of the sale are to be reinvested in short-term and negotiable securities where the money will draw practically the same rate of interest as the Hetch Hetchy bonds.

This money will not be needed at present for work in the Mountain Division and is expected to be used, in part, on the Niles-San Francisco aqueduct which will ultimately be a part of the Hetch Hetchy system. In the meantime this aqueduct will add 22,000,000 gal. per day to the San Francisco supply by tying in with the Spring Valley system in accordance with a plan recently suggested by the California Railroad Commission.

Memorial Hall for Detroit Voted

A proposed $5,500,000 bond issue for a Memorial Hall in the city of Detroit was authorized by the voters at the November election. The hall would be located near the established art center of the city and by serving as a convention hall it is expected that it would be self-supporting.

To Junk or Not To Junk Moffat R.R.

The Bankers Trust Co. of New York has asked the courts to request the receiver of the Denver & Salt Lake (Moffat) Railroad to discontinue operations. Opposed to this action are state and city governments, Denver civic organizations and private commercial interests developed along the railroad. The petition of intervention by the Denver Civic and Commercial Association is on the ground that while 1920 showed a loss, the 1921 business has so far shown a substantial profit above all costs of maintenance and operation, despite unusual business and financial depression and the large sums spent on repairs and betterments.

It is further maintained that a substantial surplus has been accumulated in the hands of the receiver, large business enterprises established on the road will be ruined by a discontinuance of service, suspension of business will greatly diminish the value of the road if it is to be sold, and maintenance of the property as abandoned property will be greatly in excess of any possible deficit because of continued operation. The association prays that the court order a strict inquiry as to feasible methods of increasing revenues and decreasing operating costs and expenses.

Ohio Water Purification Plant Operators Organize

As a result of a call issued by the Ohio State Department of Health, 46 representatives of the water filtration plants of Ohio met in Columbus, Nov. 21 and 22, and organized the Ohio Conference of Water Purification Plant Superintendents. The three main topics discussed were (1) systemization of plant and laboratory methods; (2) research work along lines suggested by the American Water Works Association; (3) monthly reports to the American Water Works Association; (3) monthly reports to the State Department of Health. There was also a question box.

Officers were elected as follows: chairman, J. W. Ellms, Cleveland; vice-chairman, J. S. Gettrust, Akron; secretary, Clarence Bahlman, Cincinnati. These three and R. W. Furman, Toledo, and F. J. Hull, Ashtabula, will constitute the Board of Directors.

Award Contract for Big Dam

The Wichita Falls (Texas) Irrigation District, Nov. 16, awarded a contract to W. E. Callahan Construction Co. for (1) an earth storage dam across the Big Wichita River 50 miles above Wichita Falls, to cost $1,259,254; (2) diversion dam of the gravity concrete spillway type with a movable crest, $726,150; (3) the South Side canal leading to Wichita Falls from the diversion dam, which is located 30 miles below the storage dam, to Lake Wichita the source of the city's water supply, $566,234; and (4) the North Side main canal, $802,573. For the four items Smith-Healey Cons. Co. bid $1,354,310, $744,700, $586,241 and $804,363, respectively. Winston Bros. bid $2,055,950 and $824,548 respectively for items 1 and 3. Womack Construction Co. bid $949,979 and $1,279,008 for items 3 and 4. Scarborough-Smith-McEnroe bid $679,932 for item 3. R. A. Thompson is chief engineer in charge of the project for the district.

Engineering Societies

Calendar

Annual Meetings

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS; Annual Meeting, Omaha, Neb., Dec. 5-8.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, New York City; Annual Meeting, New York City, Dec. 5-9.

AMERICAN ROAD BUILDERS ASSOCIATION, New York; Annual Convention and Good Roads Show, Chicago, Jan. 17-20.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; Annual Meeting, New York City, Jan. 18-19.

ASSOCIATED GENERAL CONTRACTORS OF AMERICA, Washington, D. C.; Annual Conference, Cleveland, Ohio, Jan. 17-19.

FEDERATED AMERICAN ENGINEERING SOCIETIES (American Engineering Council) Washington, D. C.; Annual Meeting, Washington, D. C., Jan. 5 and 6.

The Associated Technical Societies of Detroit, at a joint meeting, Nov. 18, sponsored by the Detroit Engineering Society, was addressed by William Ord, manager of the paving department of the Lakewood Engineering Co., on "Modern Concrete Road Construction."

The Taylor Society, New York, announces that Henry R. Towne, chairman of the board, Yale & Towne Manufacturing Co., has been elected honorary president of the society.

The Seattle Engineer's Club, at its meeting Nov. 10, was addressed by E. R. Adams, manager, Alexander & Baldwin, Ltd., owners of extensive plantations, shipping and other industries in the Hawaiian Islands, on "Industrial Conditions in the Islands."

The Seattle Section, Am. Soc. C. E., at its Nov. 10 meeting, was addressed by A. F. Wiking on "Pontoon Bridges in Sweden and the Proposed Lake Washington Bridge."

The Western Society of Engineers' program for December has scheduled the following papers on some engineering subjects: Dec. 5, "Economic Features of the St. Lawrence-Great Lakes Water Ways Project," by Francis Shenehon, consulting engineer, Minneapolis; Dec. 15, "Economic Considerations of Line Revisions on the Delaware, Lackawanna & Western R. R., by George J. Ray, chief engineer, Hoboken, N. J.; Dec. 19, "Operation of Sewage Disposal Plants," by H. H. Wagenhals, associate sanitary engineer, U. S. Public Health Service, Cincinnati. The Young Men's Forum Dec. 3 will hear S. H. Sheel, manager, investment bureau, Commonwealth Edison Co.,

Chicago, speak on "Selling the Utilities to the User." The public affairs committee, which now numbers 48 members, holds weekly lunches and recently was addressed by John Nolen, Cambridge, Mass., on the "Duty and Responsibility of the Engineer to His Fellow Citizens in City Plan Development."

PERSONAL NOTES

IVAN HOUK, who has been engineer and district forecaster of the Miami Conservancy District, Dayton, Ohio, has been appointed city engineer of Dayton.

ALFRED A. TAYLOR, who has been an employee of the New York City Street Cleaning Department for more than 20 years and for several years general superintendent of the department, has been appointed commissioner to succeed John P. Leo, resigned.

M. G. FELDRAPPE, formerly structural engineer and chief estimator for the H. K. Ferguson Co., is now with the A. A. Lane Construction Co. in a similar capacity.

LEIGH HUNT and GEORGE MARKS have associated for the practice of engineering and architecture, in Milwaukee, Wis.

MACKLIN MACK, who has been a draftsman in the Indianapolis engineering department for four years and recently senior aid in the department, has been appointed engineer for the cith planning commission.

EDWIN A. PLITT, assistant civil engineer of the Baltimore Paving Commission, has resigned to enter the U. S. Consular Service.

C. D. BUCK, formerly assistant to the chief engineer, Delaware State Highway Department, has been promoted to the position of chief engineer. During 1922 the department proposes to carry on a construction program of $2,250,000.

HENRY J. SAUNDERS, formerly with the Bureau of Valuation, Interstate Commerce Commission, San Francisco, Cal., as supervising engineer in charge of the roadway office cost and report work, has been transferred to the Washington office of the commission as assistant supervising engineer in the new consolidated organization of the Bureau of Valuation, which takes over all the valuation work formerly handled by the offices at San Francisco, Kansas City, Chicago, Chattanooga and Washington.

WILLIAM GERIG, assistant chief engineer of the Alaskan Engineering Commission, since August, 1919, has resigned owing to the near approach of completion of the Alaska R.R. Mr. Gerig was a division engineer on the Panama Canal and later consulting engineer for the U. S. Reclamation Service and the New York State Barge Canal. In 1917, he was appointed consulting engineer for harbor and pier construction for the Alaskan Engineering Commission.

LAWRENCE V. SHERIDAN, an engineer of Dallas, Texas, and formerly employed in the park department of Indianapolis, has been appointed executive secretary of the Indianapolis planning commission at a salary of $5,000 a year. He will not take up his new duties until Dec. 19. He was engineer for the Indianapolis Board of Park Commissioners, 1911 to 1914, devoting a great deal of his time to locating boulevards and inspection of construction projects. He was connected with the Bureau of Municipal Research of New York City from 1914 to 1916. In 1917 he was in charge of planning Camp Pike, Ark., the National Army cantonment. Mr. Sheridan was commissioned a second lieutenant in the third officers' training camp and served in France in 1918. Since 1919 he has been engaged in business in Dallas, where he gave considerable attention to city planning, reclamation projects and municipal development.

OBITUARY

PROF. CHARLES R. CROSS, member emeritus of the faculty of the Massachusetts Institute of Technology died Nov. 16 in Brookline, Mass. He was born in Troy, N. Y. in 1848 and received the degree of B.S. from the Massachusetts Institute of Technology in 1870. He was professor of physics at the institute from 1877 to 1917 when he was made emeritus professor. He was director of the Rogers Laboratory at the Institute from 1885 to 1917.

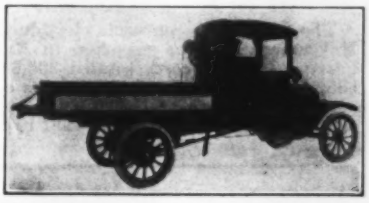
JOHN C. QUINTUS, assistant division engineer of the Great Lakes Division, U. S. Engineer's Office at Buffalo, N. Y., died in Buffalo, Nov. 27. He was born in Sheboygan, Wis., in 1856. After graduating from the University of Michigan in 1879, he joined Engineer Department of the Army and was assistant engineer on river and harbor improvement. In 1912 he became assistant division engineer to Col. James G. Warren, at Buffalo, and assistent in the design and construction of the harbor at Erie, Pa., the construction of the break-water in Buffalo harbor and the building of the Black Rock ship lock.

SIR DOUGLAS FOX, consulting engineer, of London, England, an international figure in the railway construction field, past-president of the Institution of Civil Engineers and honorary member of the American Society of Civil Engineers died in London Nov. 12, after only a few hours' illness. During recent years he had devoted much time to the designs and estimates for the proposed tunnel under the English Channel. He was born in 1840 at Bellefield, near Birmingham and began his engineering work on the Whitney Railway later being taken into partnership by his father Sir Charles Fox, a prominent consulting engineer. His principal work in this connection related first to the railways in the South of England and afterward included such projects as the Mersey River tunnel, opened to traffic in 1886, the Liverpool Overhead Railway, the London tubes, the Great Zambesi River bridge in South Africa, and the Cape Government Railways. In South America he constructed railways in the Argentine, Colombia, and Brazil. Sir Douglas was one of the founders of the British Engineering Standards Committee.

EQUIPMENT AND MATERIALS

End-Dump Hoist and Body for Ford Motor Truck

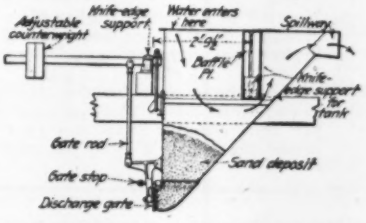
A steel body, with a hand hoist for end dump, is being built for Ford trucks by the Archer Iron Works, Chicago. With this hoist the body can



be lifted to dumping position in 30 sec. and dropped back by gravity in 5 sec. The body is steel, 44 x 14 in. x 7 ft. with a double-acting tail-gate and movable place boards.

Balanced Sand Settling Tank

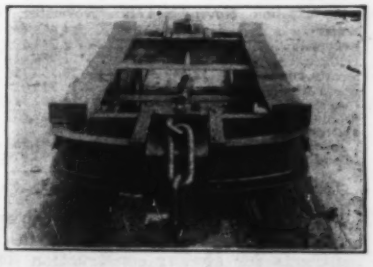
A balanced settling tank for sand and gravel washing plants has been designed by the Smith Engineering Works, Milwaukee, Wis. This tank, triangular in form and with a hopper bottom, is swung on supports and has a discharge valve opened by a lever with adjustable



counterweight. Knife edge bearings for both the tank and counterweight make the device sensitive and subject to close adjustment. In discharging, there is a double movement; the tank tips with the weight of sand, so that the bottom moves to the right. At the same time the lever opens the gate by a movement to the left, so that with ¼-in. travel of the gate there is a ½-in. gate opening.

Improved Batch Box Car

A new batch-box car intended for the 1922 market by the Koeppel Industrial Car & Equipment Co., Koppel, Pa., has oval end frames of 6-in. ship channel.



Cast steel couplers with heavy springs are used. The 14-in. wheels, on 2½ in. heat-treated steel axles, have brass or roller bearings in boxes of the double spring suspension type.

Business Side of Construction

Facts and Events that Affect Cost and Volume

November Contracts Total $96,635,585 in Value

Miscellaneous Buildings Form 45 per Cent of Total—Street and Road Work for Month is $20,750,756

The value of contracts let during November, 1921, as reported in *Engineering News-Record*, totaled $96,635,585, as against $75,665,457 for the corresponding month of 1920. This represents an increase of 27.7 per cent in the actual amount of money involved. Were consideration taken of the decrease of construction costs within the year—about 35 per cent—the value of total contracts for the past month would become about $130,000,000, or a value about 73 per cent greater than for November, 1920. In the tabulations reproduced herewith no account is taken of residential building or of housing, except that for industrial uses.

Miscellaneous building construction—which includes bank and office, business, educational, and public buildings and churches, theaters, hotels, apartments, etc.—is valued at $42,859,857, which is more than double the value of contracts for similar construction during November, 1920. Street and road work is also high the total for this class of building being $20,750,756, as against $12,443,345 for the corresponding month of 1920. Though 1921 has been a banner year in highway work, so far as the actual amount of money involved in contracts let is concerned, the indications are that 1922 will see even greater activity particularly if the high figure obtained in November for winter letting of road contracts continues.

Appropriations made for waterworks and sewer construction are about equal for the two years, the total being in either case around $7,000,000, the advantage in favor of November of 1921.

The amount of industrial construction being undertaken still fails to measure up to the corresponding month of 1920, the November figures being: 1920, $20,586,456; 1921, $11,402,944.

One of the interesting features of the comparative figures is the fact that a recent statement issuing from the War Department that the Corps of Engineers' work probably would be curtailed somewhat through lack of the appropriation of sufficient funds is apparently borne out in the value of contracts let by the Federal Government. These during November, 1921, amounted only to $693,751, as against $2,399,033 in November, 1920.

VALUE CONTRACTS LET IN NOVEMBER OF 1920 AND 1921

Classification	November, 1920	November, 1921
Waterworks	$2,150,627	$4,698,442
Sewers	4,571,862	2,733,230
Bridges	2,511,842	1,976,449
Streets, roads	12,443,345	20,750,756
Excavation	772,228	726,328
Industrial	20,586,456	11,402,944
Buildings	19,502,015	42,859,857
Federal Government	2,399,033	693,751
Miscellaneous	10,728,049	10,793,828
Totals	$75,665,457	$96,635,585

Engineering News-Record Construction Cost Index Number

December 1921	167.82
November 1921	166.32
December 1920	251.62
Peak, June, 1920	273.80
1913	100.00

Engineering News-Record's Construction Cost Index Number is 1.5 points higher than last month owing to a stronger lumber market; pine in New York is $2.50 higher than a month ago. Structural shapes in large quantities can still be bought for $1.50 per 100 lb. The average labor rate for the country this month is 45c., the same as last. Thus, general construction cost is 33 per cent cheaper than one year ago and 39 per cent under the peak; it is 68 per cent above the 1913 level.

Engineering News-Record Construction Volume Index Number

Monthly	
November 1921	101.00
October 1921	109.00
November 1920	51.00
1913	100.00
Yearly	
1921 (11 months)	85.00
1920 (11 months)	94.00
1913	100.00

Engineering News-Record's Construction Volume Index Number is 101 for the month of November, and 85 for the whole of 1921 to date, as against 100 for 1913. This means that the actual volume of construction in 1921 (not the mere money value of the contracts let this year) is 15 per cent under the volume in the first 11 months of 1913. Our monthly volume number, 101 for November, 1921, is really the increment of construction, and indicates the rate at which contracts are being let as compared with 1913 awards.

Canadian Railway Rates Cut

The Canadian Board of Railway Commissioners on Nov. 24 issued an order providing for a reduction in freight rates to become effective December 1. The order fixes freight rates on a basis of 25 per cent in the East and 20 per cent in the West above the rates effective prior to the increase made in September 1920 of 40 per cent in the East and 35 per cent in the West. Rates on coal are not altered.

Sleeping and parlor car fares are reduced to the basis of 25 per cent over the fares in effect prior to the increase in September 1920.

Cement Down in the East

On Nov. 22 the mill price of cement was dropped 15 cents per barrel in the eastern portion of the United States, from Maine to central Pennsylvania and south to Texas. The price in the Lehigh Valley district is $1.60 net, to dealers. The price at the Hudson River mills was lowered 5 cents and the lighterage charge was reduced 5 cents, making the reduction in New York and Long Island 10 cents.

Federal Court Decision Favors Trade Associations

Much of the uncertainty regarding the legality of collecting and distributing trade information has been removed by the recent decision rendered by Federal Judge Carpenter in Chicago. The government's petition for an injunction against the American Linseed Co. was denied for want of proof that a conspiracy existed in restraint of trade. The question involved was whether or not an association has the right to collect and furnish to its members current market quotations, statistics as to stocks on hand, general business conditions, or other information of interest to the trade.

The decision indicated that prices fixed by sales on an exchange establish the market at that moment, but not for some future date and that in industries where there are no exchanges the market is determined by the prices which the producers and dealers put upon their goods.

Next Week—Production and Stocks of Materials in the Country

Bids Wanted on Big Jobs

Among the jobs on which bids are asked in Construction News, pp. 239-248, are the following: A $3,500,000 railway extension of the Temiskaming & Northern Ontario Ry., from Cochrane to Newport, Ont.; a $3,000,000 library for Philadelphia, Pa.; a $1,400,000 hospital enlargement for Milwaukee, Wis.; a $1,500,000 office building for Seattle, Wash.; a $1,000,000 school for Brooklyn, N. Y.; a $750,000 temple at New Britain, Conn.; apartment hotels at Pittsburgh, Pa., and Far Rockaway, N. Y., $1,000,000 and $800,000, respectively.

California Road Contract Sought By Twenty-Two Firms

Sharp competition characterized the bidding for the first 7½-mile section of the Ocean Boulevard, which, when completed throughout, will connect the coast highway between Oxnard and San Juan Captistrano, and give Southern California 250 miles of uninterrupted coast-line highway. Twenty-two contracting firms subletted bids to the California Highway Commission for this work, which included grading a 40-ft. section and paving with cement concrete 20 ft. wide 6 in. thick, reinforced with steel rods. The bids ranged from $445,864 to $260,739. The engineer's net estimate on this section was $286,227.

Trend of Business

Stock Market—Week's average 2 points higher than previous week. Sales to Nov. 26 exceed 151,000,000 shares, against 199,000,000 in the 1920 period.

Bonds—Strong tone continues. The feature was the 104.31 bid for $11,200,000 issue State of Pennsylvania fifteen to thirty year 4¾ per cent highway bonds. "Representative Public Bond Sales for October and November" will be published in this section next week.

Money—Funds plentiful, and no tightening expected for the remainder of the year.

Foreign Exchange—Sterling held at $3.99@$4, high. No features.

Textiles—Problem: raw materials (cotton, raw silk, wool, flax) advancing, with consuming public particularly averse to price increases on finished materials at this time.

Steel—Producing at about 50 per cent. October rate was 44 per cent. For price situation see "Ups and Downs of the Market," this issue.

Milwaukee Body Recommends Aids to Unemployment Relief

Indicative of what is being done in all sections of the country to relieve unemployment are the recommendations made by the emergency employment committee of Milwaukee, Wis., which recommendation include a calling of a special session of the legislature to determine upon a 1923 road-building program, and the carrying on of extensive public work. Other recommendations are:

(1) That full use for registration and placing of men be made of the state employment bureau; (2) that the county board and city council be urged to get together immediately on the civic center plans; (3) that the zoning and city planning ordinances be promptly defined, but that no advantage be taken of the present emergency to weaken these undertakings; (4) that is considered prices will be no lower private building be begun now as it in the spring; (5) that manufacturers take advantage of the present conditions to put their plants in a high state of efficiency; (6) that owners of houses and other buildings be urged to start at once all repairs, improvements, etc.; (7) that the city council grant water and fire protection to buildings outside the city.

Labor Rates and Conditions Throughout the Country

The wage scales as applied to the construction industry seem to have become generally stabilized for the winter. The only wage change reported is non-union or common labor in San Francisco, now 45@50c., as against 50 @55c. last month.

Atlanta reports that building fell off considerably in November, but that September and October showed heavy building permits, mostly for small residences.

Lathers are on strike in Cincinnati, having refused to accept the decision of the local wage board. No further adjustments will be made in labor rates in Philadelphia until after Jan. 1, 1922.

Construction work in Detroit shows a slight decrease from operations in effect this time last month. Denver reports 90 per cent of its bricklayers and carpenters at work; about 75 per cent of the hod carriers and common laborers are employed; but only 25 per cent of the structural iron-workers can find employment.

A survey of 83 representative industries in Baltimore shows a total increase of nine per cent in the number of employees for the month ending Nov. 15.

A comparison of labor rates prevailing in Montreal in 1914 with the current wage scale, shows bricklayers receiving 55c. then as against 80c. per hr. now; carpenters received 45c. at that time as compared with the present rate of 60c. per hr. and common labor was paid 30c., whereas the rate paid today is 25@30c. per hr. Building trades wages, generally speaking, are about 75 per cent higher than they were in 1914.

Labor plentiful, all classes.—Higher rates indicated by +, decreases by—

Cities	Brick-layers	Car-penters	Hoisting Engineers	Hod Carriers	Pile Drivers	Structural Iron Workers	Common Labor
Atlanta	$0.90	$0.70	$1.00	$0.30	.....	$1.00	$0.20
Baltimore	1.25	.80	.87½	.54	$0.74	1.00	.30
Birmingham	1.00	.75	.....	.25	.....	1.00	.15@.25
Boston	.90	.75	.90	.60	.90	.90	.40
Cincinnati	1.12½	.87½	.87½	.72½	.77¼	.77½	.37½
Chicago	1.10	1.00	1.10	.....	.....	1.05	.35@.40
Cleveland	1.04	1.04	1.04	.60	.91	1.04	.57½
Dallas	1.00	1.00	1.00	.60	1.00	1.00	.35@.45
Denver	1.37½	1.00	1.00	.75@.81¼	1.00	1.00	.35@.40
Detroit	1.00	.80	.80@.90	.50@.60	1.00	.60@.80	.50
Kansas City	1.07½	1.00	1.00	.80	1.07½	1.07½	.70
Los Angeles	1.25	1.00	1.00	1.12½	.87½	1.00	50
Minneapolis	1.00	.80	.80	.65	.....	.80	.50
Montreal	.80	.60	.50	.30@.35	.50	.55	.25@.30
New Orleans	1.00	.88	.90	.40	.80	1.00	.30
New York	1.25	1.12½	1.25	87½	1.00	1.12½	.75
Pittsburgh	1.12½	1.00	1.00	.80	.....	1.00	Open
St. Louis	1.25	1.25	1.37½	.87½	1.25	1.25	.62½
San Francisco	1.16	1.03	1.03	.92½	1.03	1.16	—.45@.55
Seattle	1.00	.80	.90	.70	1.00	.80@.90	.50
Philadelphia	1.00	.90	.90	.75@90	1.00	.90	.50@.60

British Government's Decision on Unemployment Relief

(*London Correspondence*)

The British Government, in considering the various schemes for works to relieve unemployment, has come to the following decisions:

(1) In the case of non-revenue-producing works the grants will be made to the extent of 65 per cent of the interest and sinking fund charges on loans for approved expenditure.

(2) Subject to satisfactory arrangements being made for the supply of particulars of the men recruited to the employment exchange and subject to the preference to ex-service men, it will be within the discretion of local authorities to apply to boards of guardians for labor for their schemes.

(3) It is required that where a local authority undertakes the work by direct labor, the rate of wages for unskilled labor should, for a probationary period of six months, be appreciably lower than the full district rate prevailing in the area. The Cabinet Committee on Unemployment understands that local authorities will be assisted by a closer definition of the proportion of the full rate of wages which should be paid on these works, and they have decided that the rate of wages in such cases must not exceed 75 per cent of the local authority's rate for unskilled labor. This requirement of a lower rate of wages than the prevailing local rate does not, of course, apply in the case of schemes carried out by ordinary contract.

If you don't see it in the Business Side of Construction, why not ask us to put it there?

Colorado Society of Engineers Reports Better Conditions

Engineering in Colorado, as reflected by the employment bureau of the Colorado Society of Engineers, is in a less critical condition than in other parts of the country. The number of positions filled by the free bureau is running 50 per cent lower than last year. Nevertheless, less than 5 per cent of the society members are without work. According to the society the city of Denver has found it necessary to investigate the exorbitant fees charged by some of the employment agencies and to start an agency of its own.

How's Your Business?

Myers-Whaley Co., Knoxville, Tenn., makers of shovel loaders for tunnel work—"Sales and shipments to Sept. 1 were 78 per cent of those for the same period of 1920. Prospects for new business depend on general condition of mining, etc. Prospects for fall and winter business uncertain."

Barber-Greene Company, Aurora, Ill., material-handling machines—"Business so far this year has been 46¼ per cent of that for the same period of 1920. Indications are that business will be much more than 46¼ per cent of last year by the end of the year. We do not look for any great revival this fall or winter but look for good business in 1922, beginning in the spring. We cannot see that business conditions are greatly improved but at the same time we can detect a better spirit and much more confidence in the future."

Census of Manufactures Practically Complete

The general schedule for the census of manufactures in the United States for the year 1921 has been practically completed. This two-year census will make available to industry a great deal of useful information which has heretofore been more or less fragmentary. Among the salient facts included in the census are amount of wages and salaries paid, the number of days factories were in operation during the calendar year, the number of hours normally worked by wage earners per shift and per week, the quantity produced of the principal products in manufacturing industries, the total value of all products, and the cost of all materials used in the manufacture of those products.

Employment Rose One Per Cent During October

A general improvement in industrial conditions during October and an estimated decrease of unemployment by 1.01 per cent between September 30 and October 31 is indicated in a recent statement issued by the U. S. Labor Bureau. The estimate as to unemployment is based on reports received from 1,428 firms engaged in all kinds of industries.

A census of unemployment in New York City made by the committee on unemployment statistics appointed by the commissioner of public welfare shows that 343,000 persons were unemployed during the week of Oct. 17. This does not include a large number who are working on part time. Those out of work represent a total of about 13¼ per cent of the city's 2,531,747 residents employed in gainful occupations as shown by the 1920 census. To this figure are added the idle from out of town estimated at from 20,000 to 50,000.

Monthly Prices of Construction Materials

Ups and Downs of the Market

Railway Supplies—Reduction of $5 on standard bessemer rails and $7 per ton on openhearth rails, Pittsburgh mills. Standard spikes quoted at $2.25 as against $2.30@$2.40; track bolts, $3.25@$3.50 as compared with $3.25@$3.55 per 100 lb., last month.

Pipe—Additional discounts of 3% quoted on all sizes, black and galvanized wrought steel pipe in New York warehouses. Drop of $2 quoted on 4-in. cast iron pipe in New York; $2 on 4-in. and $1 per ton on 6-in. Birmingham. San Francisco quotes advance of $1 per ton on 4-in. cast iron pipe.

Road and Paving Materials—Atlanta quotes asphalt at $27.50 as against $30 per ton in package. Decrease of 75c. per sq.yd. on wood blocks in St. Louis.

Sand, Gravel and Crushed Stone—New York quotes sand at $1 as against $1.25, and gravel at $1.75 as compared with $2 per cu.yd. one month ago. Gravel, ready mixed, current price $2 per cu.yd. Atlanta quotes decrease of 10c. in sand and 15c. per ton in gravel. Crushed stone in Atlanta $2 per ton as against $2.25.

Lime—New York quotes common lump lime at $3.39@$3.69 as against $3.69 per 280 lb. barrel (net). Reduction of 10c. per bbl. reported on lump finishing lime in Minneapolis, and on common lump in Atlanta. Seattle quotes reduction of 50c. per ton on hydrated finishing lime and Sheboygan lime is quoted in Minneapolis at $1.55 as against $1.60 per 180-lb. barrel.

Cement—Mills supplying New York quote $1.90 alongside dock, as against $2.10 per bbl. net; dealers hold to the $2.40 delivered price. St. Louis quotes $1.97, as against $2.25; Jersey City, $2.13 as compared with $2.28 a month ago. Decreases ranging from 15c. to 25c. per bbl. reported at certain of the principal cement mills.

Structural Material—Shapes, plates and bars $1.50, Pittsburgh, in large tonnages; small tonnages $1.60 per 100 lb. New York warehouses quote reduction of 10c. per 100 lb. on structurals, and advances ranging from 95c. to $1 per 100 yd. on expanded metal lath. Structural rivets $2.25@$2.40, Pittsburgh, as against $2.40, and ¾-in. cone-head boiler rivets $2.35@$2.50 as compared with $2.50 per 100 lb., formerly. Pittsburgh mills quote drop of 40c. on cut nails. San Francisco warehouses quote a decrease of 25c. on cut nails and an advance of 10c. per keg on wire nails.

Lumber—Advance of $2.50 per M. ft., b.m., wholesale, on long-leaf yellow pine, base sizes, quoted in New York. Pine lumber advanced $1 in Minneapolis, and increases ranging from $1 to $2.50 per M. ft. reported in Atlanta. Douglas fir up 50c. in Seattle, $3 in Los Angeles, and from 50c. to $2 in Minneapolis. Denver quotes decreases of 50c. to $3 in Douglas fir, base sizes. Hemlock up $2 in Minneapolis and down $1 per M. ft. in Los Angeles.

Manila Rope—Advanced 1c. per lb. in New York and Atlanta.

Explosives—Sixty per cent gelatin dynamite down 2c. per lb. in Los Angeles. Prices stable elsewhere.

Linseed Oil—Chicago quotes 76c. as against 72c. per gal. New York quotations same as in effect one month ago.

Price advances since last month are indicated by **heavy type**; declines by *italics*

PIG IRON—Per Gross Ton—Quotations compiled by The Matthew Addy Co.:

	Current	One Year Ago
CINCINNATI		
No. 2 Southern (silicon 2.25 @ 2.75)	$22.50†	$46.50
Northern Basic	*22.02†*	40.00
Southern Ohio No. 2 (silicon 1.75 @ 2.25)	23.52†	47.00
NEW YORK, tidewater delivery		
Southern No. 2 (silicon 2.25 @ 2.75)	*22.50†*	52.10
BIRMINGHAM		
No. 2 Foundry (silicon 2.25 @ 2.75)	*18.00†*	42.00
PHILADELPHIA		
Eastern Pa., No. 2X, (2.25@2.75 sil.)	**23.26†**	46.00*
Virginia No. 2 (silicon 2.25 @ 2.75)	28.74†	46.25†
Basic	20.75†	44.00*
Grey Forge	**22.50†**	45.50
CHICAGO		
No. 2 Foundry Local (silicon 1.75 @ 2.25)	*21.70†*	43@45
No. 2 Foundry Southern (silicon 2.25 @ 2.75)	*24.66†*	46@48
PITTSBURGH, including freight charge from the Valley		
No. 2 Foundry Valley (silicon 1.75 @ 2.25)	*22.46†*	44.00
Basic	*20.96†*	38.00
Bessemer	21.96†	42.00

*F.o.b. furnace. † Delivered.

RAILWAY SUPPLIES

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots. For less than carload lots 5s. per 100 lb. is charged extra:

	Pittsburgh			
	Current	One Year Ago	Birmingham	Chicago
Standard bessemer rails	*$40.00*	$45@55	.....	**$40.00**
Standard openhearth rails	*40.00*	47@57	$40.00	40.00
Light rails, 8 to 10 lb	31.00@33.00	2.88@4.00*	1.60*	1.65@1.80*
Light rails, 12 to 14 lb	31.00@33.00	2.84@3.84*	1.60*	1.65@1.80*
Light rails, 25 to 45 lb	31.00@33.00	2.75@3.75*	1.60*	1.65@1.80*

*Per 100 lb.

RAILWAY TIES—For fair-sized orders, the following prices per tie hold:

	6 In. x 8 In. by 8½ Ft.	7 In. x 9 In. by 8 Ft. 6 In.
Chicago, White Oak	$1.35	$1.50
Chicago, Hardwood and Red Oa	1.20	1.30
Chicago....Empty Cell Creosoting (add'l)	.45	.50
San Francisco..... Green Douglas Fir	.75	.97
San Francisco, Empty Cell Creosoted, Douglas Fir	1.70	2.20

For ties on standard "railroad administration" specifications, f.o.b. cars, St. Louis:

	White Oak	Red Oak	Pine and Sap Cypress
Grade 3	$1.15	$1.05	$0.95
Grade 2	1.05	.95	.85
Grade 1	.95	.85	.75

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh					
	Current	One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅜-in. and larger	$2.25	$4.00@4.25	$2.88	$3.60	$4.50	$4.05
Track bolts	*3.25@3.50*	6.00@6.50	3.88	4.60	5.50	4.15
Standard section angle bars	2.75	3.00@4.00	2.88	3.25	4.00	3.25

PIPE

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

BUTT WELD

Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
1 to 3	68½	56	⅛ to 1¼	44½	29½

LAP WELD

2	61½	49	2	39½	25½
2½ to 6	65½	53	2½ to 6	42½	29½
7 to 8	62½	49	7 to 12	40½	27½
9 to 12	61½	48			

BUTT WELD, EXTRA STRONG, PLAIN ENDS

1 to 1¼	66½	55	1 to 1¼	44½	30½
2 to 3	68½	56			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	59½	48	2	40½	27½
2½ to 4	63½	52	2½ to 4	45½	31½
4½ to 6	62½	51	4½ to 6	44½	30½
7 to 8	58½	45	7 to 8	35½	23½
9 to 12	52½	39	9 to 12	30½	18½

STEEL—From warehouses at the places named the following discounts hold for steel pipe:

	Black		
	New York	Chicago	St. Louis
1 to 3 in. butt welded	65%	60%	56½%
3½ to 6 in. lap welded	54%	57%	53½%

	Galvanized		
	New York	Chicago	St. Louis
1 to 3 in. butt welded	49%	46%	42½%
3½ to 6 in. lap welded	40%	43%	39½%

Malleable fittings, Class B and C, from New York stock sell at list less 5% Cast iron, standard sizes, 32½ off.

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	New York					
	Current	One Year Ago	Birmingham	Chicago	St. Louis	San Francisco
4 in.	*$50.30*	$87.22	*$38.00*	*$46.60@48.10*	$46.20	**$54.00**
6 in. and over	47.30@48.30	77.22	*35.00*	*42.60@44.10*	43.20	50.00

Gas pipe and Class "A," $3 per ton extra; 16-ft. lengths, $1 per ton.

CLAY DRAIN TILE—The following prices are per 1000 lin.ft.:

	New York					
Size, In.	Current	One Year Ago	St. Louis	Chicago	San Francisco	Dallas
3	$40.00	$62.00	$35.00	$50.00	.....	$55.00
4	50.00	77.00	85.00	60.00	$90.00	65.00
5	80.00	110.00	140.00	80.00	115.00	84.00
6	105.00	140.00	140.00	100.00	150.00	110.00
8	175.00	228.00	200.00	150.00	250.00	181.00

SEWER PIPE—The following prices are in cents per foot for carload lots:

Size, In	New York Delivered	Pittsburgh	Birmingham	St. Louis	Chicago	San Francisco	Dallas
3	$0.14	$0.087	.....	$0.1175	$0.12	$0.12	.....
4	.14	087	$0.09	.1575	.12	.15	$0.18
5	.21	.1305	.....	.1645	.18	.18	.165
6	.21	.1305	.135	.225	.18	.21	.25
8	.35	.203	.225	.315	.28	.30	.35
10	.52	.3045	.....	.329	.42	.42	.....
12	.67	.3915	.3825	.441	.54	.54	.80
15	1.15	.522	.5625	.73	.72	.90	.....
18	1.55	.725	.765	1.029	1.00	1.32	.....
20	1.98	.87	1.125	1.372	1.20	.....	.....
22	2.64	1.16	.....	.....	1.60	.....	.....
24	2.97	1.305	1.4625	1.95	1.80	2.16	2.40
27	4.50	1.885	.....	2.75	3.75	3.00	.....
30	5.00	2.088	3.20	3.40	4.75	3.60	.....
33	6.55	2.61	.....	4.05	5.50	.....	.....
36	7.50	2.9725	.....	4.70	6.00	.....	.....

	3	5	8	12	24	36
Boston	$0.108	$0.162	$0.252	$0.486	$1.62	$4.92
Minneapolis	.....	.....	.40	.77	2.55	5.66
Denver	.....	.15	.30	.50	1.95	.....
Seattle	.145	.....	.36	.72	2.59	.....
Los Angeles	.11*	.165*	.275	.495	1.65	.....
New Orleans	.....	.108	.27	.459	1.755	.....
Cincinnati	.10	.15	.233	.45	1.50	4.305
Atlanta	.098*	.147*	.245	.4165	1.5925	.....
Montreal, *delivered*	.30*	.45*	.85*	1.35	4.50	6.50
Detroit	.105	.1575	.245	.4725	2.115	5.4325
Baltimore *(f.o.b.)*	.1225	.2275	.35	.6885	2.28	5.20
Kansas City, Mo	.15	.21	.335	.60	2.41	4.74
Philadelphia	.095	.145	.225	.43	1.44	4.60

*4-in., 6-in., 9-in., respectively.

ROAD AND PAVING MATERIALS

ROAD OILS—Following are prices per gallon in tank cars 8,000 gal. minimum f.o.b. place named:

		Current	One Year Ago
New York, 45% asphalt	(at terminal)	$0.05½	$0.12
New York, 65% asphalt	(at terminal)	.05	.12
New York, binder	(at terminal)	.08	.12
New York, flux	(at terminal)	.06½	.11
New York, liquid asphalt	(atterminal)	.06½	.11
St. Louis, 50-60% asphalt *(f.o.b.) Tulsa, Okla.*		.015*	.12
Chicago, 40-50% asphalt		.05	.08½
Chicago, 60-70% asphalt		.05½	.08½
Dallas, 40-50% asphalt		.10	.10
Dallas, 60-70% asphalt		.13	.13
Dallas, 75-90% asphalt		.15	.15
San Francisco, binder, per ton		15.00†	15.00

* Freight $21.75 per ton to Whiting, Ind.
† F.o.b. Oleum, Cal. Freight to San Francisco, 80c. per ton.

ASPHALT—Price per ton in packages (350-lb. bbl. or 425-lb. drums) and in bulk in carload lots:

	Package	Bulk
New York (Bayonne, N. J.)	$26.00	$17.00
Boston	No quotations	
Chicago	25.85	19.50
San Francisco, *f.o.b. refinery*, Oleum, Cal.	21.50*	15.00*
Dallas	35.00	27.00
Seattle	27.50	21.50
Denver	45.00	65.00
Minneapolis		20.50
St. Louis	28.00	22.00
Baltimore	28.00	
Los Angeles, *at factory*	22.50	15.00
Montreal	28.00	21.00
Atlanta	*27.50*	
Detroit (petroleum asphalt)	24.50	20.00
Cincinnati	26.10	21.80
Maurer, N. J. (asphalt)	27@38	
Maurer, N. J. (asphalt cement)	29@36	25@31
Philadelphia	22.00	16.50

*Freight to San Francisco, 80c. per ton.

NOTE—Barrels or drums are optional in most cities. About 6 bbls. to the ton, and from 4 to 5 drums. Rebates of about $1 per bbl., no rebate for drums.

PAVING STONE—

New York	5-in. granite, 28@29 blocks per sq.yd.		$130.00 per M
Chicago	About 4x8x4 dressed		3.35 sq.yd.
	About 4x8x4 common		3.00 sq.yd.
San Francisco	Basalt block 4x7x8		65.00 per M
Boston	5-in. granite		125.00 per M
Atlanta	Granite		2.00 sq.yd.
Detroit	Granite, 26½ blocks per sq.yd.		107.00 per M
Baltimore	Granite		2.15 sq.yd.
Montreal	Granite		125.00 per M
New Orleans	Granite, 4 x 8 x 4		3.25 sq.yd.
Cincinnati	Granite		4.30 sq.yd.
St. Louis	4x8x4 dressed		3.25 sq.yd.
	4x8x4 common		3.00 sq.yd.
Kansas City	No. 1 Granite		3.95 sq.yd.
Philadelphia	Granite		2.10 sq. yd.

FLAGGING—

New York	Bronx	$0.25	sq.ft.
	Manhattan, 4 ft.	.26	sq.ft.
	Queens, 5 ft.	.26	sq.ft.
	6x20-in. cross-walk	1.00	lin.ft.
Chicago	18 in. wide	.99	lin.ft.

CURBING—Bluestone per lineal foot, in New York, costs 77c. for 5x16 in., 88c. for 5x18 in.; in cargo lots.

WOOD BLOCK PAVING—

	Size of Block	Treatment	Per Sq.Yd.
New York	3	16	$2.09
New York	3½	16	2.17
New York	4	16	2.37
Boston	3	16	2.17
Chicago	4	16	3.00@3.25
Chicago	3½	16	2.50@2.75
St. Louis	3½	16	*2.50*
St. Louis	4	16	*3.00*
Seattle	4	16	Off market
Minneapolis	3½	16	2.13
Atlanta	3½	16	2.30
New Orleans	3	16	2.00
New Orleans	3½	16	2.25
New Orleans	4	16	2.50
Dallas	4	18	3.90
Baltimore	3½	16	3.60
Montreal, *delivered*	4	16	4.50
Detroit	3	16	2.84
Detroit	4	16	3.00
Cincinnati	4	16	2.60
Kansas City	4	16	2.15
Philadelphia	3½	16	3.50

CONSTRUCTION MATERIALS

SAND AND GRAVEL—Price for cargo or carload lots is as follows, per cu.yd.:

	Gravel 1½ In. Current	Gravel 1½ In. One Year Ago	Gravel ¾ In. Current	Gravel ¾ In. One Year Ago	Sand Current	Sand One Year Ago
New York	*$1.75*	$3.00	*$1.75*	$3.00	*$1.00*	$1.50
Denver	2.50	2.00	2.50	1.80	1.10	1.60
Chicago	**2.00**	2.75	**2.00**	2.75	**2.00**	2.75
St. Louis, *per ton*	1.30	1.65	1.25	1.70	1.20*	1.70
Seattle	1.50	1.25	1.50	1.25	1.50	1.25
Dallas, *delivered*	2.25	2.50	2.25	2.50	2.25	2.00
Minneapolis, *at pit*	1.50	2.00	1.50	....	.50	1.25
Cincinnati	1.87½	2.00	2.03	2.00	1.60	2.00
San Francisco	2.25	2.50	2.25	2.50	1.50	1.65
Boston, per ton	2.65	2.00	2.65	2.60	2.00	1.60
New Orleans	2.85	3.60	....	....	1.35	1.85
Los Angeles, per ton	1.35†	1.25	1.35†	1.25	1.20†	1.15
Atlanta, per ton	*1.85*	3.12	*1.85*	....	*1.85*	1.62
Detroit	2.00	1.85*	2.00	1.85*	2.00	3.50
Baltimore, per ton	1.40	1.40‡	1.60	1.60‡	2.40	.70
Montreal, per ton	1.25	1.50‡	1.50	....	1.25	1.25‡
Birmingham, per ton (Crushed slag used instead of gravel)					1.28	1.25‡
Philadelphia	1.40	....	1.55	....	1.90	....

* Fine white sand: Pacific, $4 per ton; Ottawa, $4.50

† Freight from quarry to Los Angeles is 70c. per ton, and is included in above price.

‡ Per cu. yd.

CRUSHED STONE—Price for cargo or carload lots f.o.b. city, unless stated otherwise, is as follows, per cu.yd.:

	1½ In. Current	1½ In. One Year Ago	¾ In. Current	¾ In. One Year Ago
New York	$1.80@1.90	$1.90@2.00	$1.80@1.90	$2.15
Chicago	1.60	2.75	1.60	2.75
St. Louis *delivered*	1.55*	2.00	1.55*	2.00
Dallas, *delivered*	3.20	2.50	3.20	2.50
San Francisco	2.25	2.50	2.25	2.25
Boston, *delivered*	3.00*	3.00* (del.)	3.00*	3.00* (del.)
Minneapolis, *at plant*	2.00	2.00	2.25	2.50
Kansas City	2.75	2.35	2.75	2.35
Denver	3.50		3.50	
Seattle *delivered*	3.00	3.50 (del.)	3.00	3.50 (del.)
Atlanta	*2.00*	3.25	*2.00*	3.50
Cincinnati *delivered*	2.37½	....	2.08	2.15
Los Angeles	1.60*	1.60*	1.70*	1.70*
Detroit	1.90*	2.00	1.90*	2.00*
Baltimore	1.75*	1.75*	1.65*	1.75*
Montreal	2.00*	2.30*	2.10*	2.55*
Birmingham *delivered*	3.20	....	3.10	....
Philadelphia	1.70*	....	1.60*	....

*Per ton.

CRUSHED SLAG—Price of crushed slag in carload lots, per net ton, at plants:

	1½-In.	¾-In.	Roofing	Sand
Lebanon or Bethlehem, Pa.	$1.00	$1.00	$2.50	$0.90
Easton or Catasauqua, Pa.	1.00	1.00	2.00	.90
Buffalo, N. Y. and Erie, Pa.	1.25	1.25	2.25	1.25
Emporium, Pa.	1.25	1.25	....	1.25
East Canaan, Conn.	1.25	1.35	4.00	1.10
Birmingham, Ala.	.75	.95	2.05	.80
Toledo, Ohio	1.50	1.50	2.35	....
Atlanta, Ga.	....	2.10	....	....
Easter Pennsylvania and New Jersey	1.20	1.20	2.50	.90
Westrn Pennsylvania and New Jersey	1.25	1.25	2.50	1.25

Birmingham, f.o.b. sidings $1.12 (or $1.45 per cu. yd. on site)

LIME—Warehouse prices:

	Hydrated, per Ton Finishing	Hydrated, per Ton Common	Lump, per 180-Lb. Barrel (net) Finishing	Lump, per 180-Lb. Barrel (net) Common
New York	$16.99	....	....	*$3.39*@3.69*
Chicago	18.00	....	....	1.40
St. Louis	0.58	$0.50	$2.25	0.70*
Boston	23.00	20.00	3.35	3.10
Dallas	25.00	....	....	2.75
Cincinnati	0.49	0.45	....	....
San Francisco	22.00	18.00	....	1.90
Minneapolis	29.00	22.00 (white)	*1.70*	1.40
Denver	30.00	....	95†	2.95
Detroit	15.25	13.25	11.50‡	10.50‡
Seattle	*27.00*	....	3.25	2.75
Los Angeles	30.00	30.00	3.00*	3.00*
Baltimore	15.00	13.00	....	12.00‡
Montreal	21.00	21.00	15.00‡	15.00‡
Atlanta	19.00	16.00	2.00	*1.50*
New Orleans	....	17.25	....	1.75
Philadelphia	14.50	12.50	....	11.00‡

* 280-lb. barrels (net). † Per bushel. ‡ Per ton.

Minneapolis quotes brown lime; Kelly Is. white is $1.70, Sheboygan *$1.55*

Cincinnati and St. Louis quotes hydrated lime per 50-lb. sack.

Seattle quotes hydrated finishing lime in cloth sacks; paper sacks, $24.00 per ton.

NOTE—Refund of 10c per barrel.

NATURAL CEMENT—Price to dealers per bbl. for 500 bbl. or over, f.o.b., exclusive of bags:

	Current	One Year Ago
Minneapolis (Rosendale)	$2.80	$1.85
Kansas City (Ft. Scott)	1.60	1.60
New Orleans	3.16	3.36
Atlanta (Magnolia)	11.00 ton	1.90
Cincinnati (Utica)	1.77	2.85
Boston (Rosendale)	.85@.95	2.35

PORTLAND CEMENT—Current prices are for barrels in carload lots, *without* bags, to contractors:

	Current	One Month Ago	One Year Ago
	Without Bags		Without Bags
New York (delivered)	$2.40	$2.40	$4.10
New York, alongside dock to dealers	*1.90*	2.10	....
Jersey City	*2.13*	2.28	3.55
Boston	2.61	2.61	3.63
Chicago	1.97	1.97	2.35
Pittsburgh	2.02	2.02	2.42
Cleveland	2.28	2.28	2.73
Detroit	2.31	2.31	2.78
Indianapolis	2.23	2.23	2.61
Toledo	2.31	2.31	2.71
Milwaukee	2.19	2.19	2.59
Duluth	1.95	1.95	2.35
Peoria	2.14	2.14	2.63
Cedar Rapids	2.28	2.28	2.71
Davenport	2.22	2.22	2.67
St. Louis	*1.97*	2.25	3.45
San Francisco	2.84	2.84	3.09
New Orleans	2.88	2.88	4.60
Minneapolis (on cars)	2.26	2.26	3.50
Denver	3.10	3.10	3.25
Seattle	3.10	3.10	3.12
Dallas (f.o.b.)	2.55	2.55	3.85
Atlanta	**2.69**	2.60	3.75
Cincinnati	2.37	2.37	3.32
Los Angeles	3.31	3.31	3.10
Baltimore (del.)	2.88	2.88 (del.)	4.08 (del.)
Birmingham	2.27	2.27	....
Kansas City	2.45	2.45	2.76
Montreal (delivered)	**3.12**	3.21 (del.)	2.95 (inc. bags)
Philadelphia	2.50 (del.)	....	....

NOTE—Bags 10c. each. 40c. per bbl.; 80c. per bbl. in Montreal.

Current mill-prices per barrel in carload lots, without bags; to contractors:	
Buffington, Ind.	$1.70
Pittsburgh, Pa.	1.75
Steelton, Mian.	1.75
Northampton, N. Y.	*1.60*
Hudson, N. Y.	*1.80*
Vulcanite, N. J.	*1.70*
Lehigh Valley District	1.70

TRIANGLE MESH—Price per 100 sq.ft. in carload lots:

PLAIN 4-INCH BY 4-INCH MESH

Style Number	Weight in Pounds	Pittsburgh, Mill	New York (Warehouse)	Chicago	Dallas	San Francisco
032	0.22	$0.74	$1.13	$0.82	$1.15	$1.24
049	0.28	.94	1.40	1.05	1.46	1.56
068	0.35	1.14	1.67	1.27	1.80	1.92
093	0.45	1.46	2.11	1.63	2.30	2.46
126	0.57	1.80	2.58	2.02	2.86	3.07
153	0.68	2.14	3.05	2.40	3.40	.....
180	0.78	2.46	3.48	2.76	3.93	.....
245	1.03	3.24	4.55	3.63	5.15	.....
287	1.19	3.75	5.25	4.20	5.96	6.41
336	1.38	4.35	6.07	4.87	7.32	.....
395	1.60	5.04	7.01	5.65	8.00	.....
			PAVING			
036P	0.17	$0.56	$0.88	$0.62	$0.88	.....
053P	0.24	.79	1.20	0.88	1.24	.....
072P	0.31	.99	1.48	1.11	1.57	.....
097P	0.40	1.28	1.87	1.43	2.02	.....
049R	0.24	.79	1.20	....	1.24	.....
067R	0.31	.99	1.48	....	1.57	.....
084R	0.40	1.28	1.87	....	2.02	.....

Made in 16-, 20-, 24-, 28-, 32-, 36-, 40-, 44-, 48-, 52- and 56-in. width in rolls 150-, 200- and 300-ft. lengths. Galvanized is about 15% higher.

EXPANDED METAL LATH—Prices in carload lots per 100 yd. for painted are as follows:

Gage	Weight	*New York	Chicago	St. Louis	San Francisco	Dallas
27	233	$24 20	$23 39	$23.39	$27 62	$25 50
26	250	25 65	24 93	.....	29.21	27 56
25	300	28 30	27 45	27 45	.....	30 71
24	340	30 10	29 33	29.33	35.73	33 16
22	433	34.75	34 06	.....	.....	35 10

* Price to contractors at warehouse or delivered on job in Manhattan, Bronx or Brooklyn.

BARS, CONCRETE REINFORCING—Current quotations per 100 lb.:

ROLLED FROM BILLETS

Inches	*Pittsburgh Mill	Birmingham Mill	Warehouse, Uncut: New York	Chicago	St. Louis	Dallas	San Francisco
½ and larger	$1.50	$1 75	$2.68	$1 90	$2 87	$3 50	$3.00
⅝ and larger	1.55	1 90	2.73	1 95	2 92½	3.55	3.05
¾ and larger	1.60	1 90	2.78	2.00	2 97½	3.60	3.10
⅞ and larger	1.75	1 90	2.83	2.15	3 12½	3.75	3.25
1 and larger	2.00	1.90	2.88	2.40	3.37½	4.00	3.50

* Pittsburgh mill prices on large tonnages only.
Includes 15c charge for cutting to lengths of 2 ft. and over.
Twisted bars cut to length take extra of 27½c. per 100 lb.

ROLLED FROM RAILS

	Chicago	St. Louis	Dallas		Chicago	St. Louis	Dallas
½ and larger	$1.75	$1.90	$3.25	½	$2.00	$2 15	$3 50
⅝ in.	1.80	1 95	3 30	¼	2.25	2.40	3.75
¾	1.85	2.00	3.35		.....	.....	.....

BRICK—Contractors price per 1,000 in cargo or carload lots is as follows:

	Common: Current	One Month Ago	One Year Ago	Paving Block 3-inch*	Paving Block 4-inch*
New York (del.)	$18.40	$18.40	$22.70	$47.00	$42.50
New York (at dock)	15.00	15.00	.....	.....	.....
Chicago	11.00	11.00	15.00	34.00	42.00
St. Louis, salmon	17.00	17.00	17.00	.....	.....
Denver, salmon	14.00	14.00	15.00	.....	.....
Dallas	12.72	12.72	25.00	44.00	.....
San Francisco	18.00	18.00	18.00	.....	44.38
Los Angeles	15.50	15.50	13.50	(not used)	
Boston (del.)	17.00	17.00	30.00	46.00	56.25
Minneapolis (del.)	17.00	17.00	24@26	.....	43.00
Kansas City	14.50	14.50	22.00	.....	.....
Seattle	14.00	14.00	19.00	48.00	53.50
Cincinnati	18.00	18.00	22@23	41.00	.....
Montreal (del.)	16.00	16.00	20.00	100.00	120.00
Detroit (del.)	15.00	17.00	20.00	41.30	44.00
Baltimore (del.)	20.00	20.00	20@25	38.00‡	.....
Atlanta	9.00	11.00	20.00	40.00	.....
New Orleans	14.00	14.00	25.50	.....	.....
Birmingham	11.50	11.50	.....	.....	.....
Philadelphia	16.00@19.00	.....	.....	.....	42.00

* For paving blocks 3½x8½x3 and 3½x8½x4 respectively. ‡ Vitrified, f.o.b. plant, Baltimore.

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York: Current on Trucks*	New York: One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco	Perth Amboy N. J., Factory
4x12x12	$0.11120	$0.2444	$0.0691	$0.145	$0.145	$0.145	.....
6x12x12	.15160	.3259	.0950	.195	.195	.20	.....
8x12x12	.20210	.4345	.1295	.245	.145	.315	$0.17810
10x12x12	.....	.....	.1584	320	200	.....	22260
12x12x12	.....	.....	.1811	395	230	.....	26720

* 5 per. off for cash.

	4x12x12	8x12x12	12x12x12
Boston	$0.0965	$0.182	$0.251
Minneapolis (f.o.b. cars)	.0712	.11125	.188
Minneapolis (delivered)	.0792	.12375	.208
Cincinnati	.0682	.128	.175
Kansas City	.085	.167	.270
Denver	.09	.16	.23
Seattle	.10	.175	.30
Los Angeles factory	.103	.185	.22
New Orleans	.14	.25	.42
Detroit (delivered)	.070	.135	.225
Montreal	.15	.30	.35
Baltimore	.16	.26	.42
Atlanta	.0675	.13	.....
Dallas	.124	.....	.....
Birmingham	095	1785	.....

San Francisco and New York quote on hollow partition tile.

STRUCTURAL MATERIAL—Following are base prices f. o. b. mill, Pittsburgh and Birmingham together with quotations per 100 lb. from warehouses at places named:

	*Pittsburgh, Mill	Birmingham Mill	New York (del.)	Dallas	St. Louis	Chicago (del.)	San Francisco
Beams, 3 to 15 in.	1.50	$1.90	$2.78	$4 00	$2 97½	$2 88	$3 70
Channel, 3 to 15 in.	1.50	1.90	2.78	4 00	2 97½	2.88	3 70
Angles, 3 to 6 in., ¼ in. thick	1.50	1.90	2.78	4 00	2 97½	2 88	3 70
Tees, 3 in. and larger	1.50	1.90	2.78	4 00	2 97½	2 88	3 70
Plates	1.50	1.90	2.78	4 00	2 97½	2 88	3.70

* Pittsburgh mill price on large tonnages; small tonnages $1.60 per 100 lb.

RIVETS—The following quotations are per 100 lb.:

STRUCTURAL

	Pittsburgh, Mill	New York: Current	New York: One Yr. Ago	Warehouse: Chicago	Warehouse: St. Louis	Warehouse: San Francisco	Warehouse: Dallas
½ in. and larger	$2.25@2.40	$3.70	$6.11	$3.43	$3 77½	$5.50	$5 50

CONE HEAD BOILER

½ in. and larger	2.35@2.50	3 80	7.10	3.53	3 87½	5 60	5 65
⅝ and ¾	2.50@2.65	3 95	7.25	3.68	3 87½	5 75	5 80
⅞ and 1	2.75@2.90	4 20	7.50	4.18	3 87½	6 00	6.05

Lengths shorter than 1 in. take an extra of 50c. Lengths between 1 in. and 2 in. take an extra of 25c.

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh, Mill	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2 90	$3 60	$4 90	$5 00	$3 48	$4 95
Cut	2 60	6 10	6 00	7 75	4 08	5 00

PREPARED ROOFINGS—Standard grade rubbered surface, complete with nails and cement, costs per square as follows:

	New York: 1-Ply l.c.l.	New York: 2-Ply l.c.l.	New York: 3-Ply l.c.l.	Philadelphia: 1-Ply l.c.l.	Philadelphia: 2-Ply l.c.l.	Philadelphia: 3-Ply l.c.l.
No. 1 grade	$2.12	$2.48	$2.90	$2.02	$2.38	$2 80
No. 2 grade	1.87	2.18	2.55	1.77	2.08	2 25

Slate-surfaced roofing (red and green) in rolls of 108 sq.ft. costs $2.15 per roll in carload lots and $2.40 for smaller quantities f.o.b. Philadelphia.

Shingles, red and green slate finish, cost $6.15 per square in carloads; $6.40 in smaller quantities, in Philadelphia.

ROOFING MATERIALS—Prices f.o.b. New York:

Tar felt (14 lb. per square of 100 sq.ft.) per roll of 432 sq.ft.	$2.35
Tar pitch (in 400-lb. bbl.), per 100 lb.	1.85
Asphalt roofing (in barrels), per ton	47.50
Asphalt felt (light), per ton	77.00
Asphalt felt (heavy), per ton	78.50

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	St. Louis	Chicago	San Francisco	New York
No. 10	$2.25@2.50	$2.87½	$3.38	$5.25	$3.53
No. 12	2.30@2.55	2.92½	3.43	5.30	3 58
No. 14	2.35@2.60	3.97½	3.48	5.35	3 63
No. 16	2.80	3.07½	3.58	5.45	3 73
Black					
*Nos. 18 and 20	2.60@2.85	3 95	3.95	5.55	3.80
*Nos. 22 and 24	2.65@2.90	4 00	4.00	5.60	3.85
*No. 26	2.70@2.95	4 05	4.05	5.65	3.90
*No. 28	2.75@3.00	4.15	4.15	5.75	4.00
Galvanized					
No. 10	2.75@3.00	4.15	4.15	....	4.00
No. 12	2.85@3.10	4 25	4.25	5 95	4.10
No. 14	2.85@3.10	4.25	4.25	5 95	4.10
Nos. 17 to 21	3.15@3.40	4 55	4.55	6 25	4.40
Nos. 22 and 24	3.30@3.55	4 70	4.70	6 40	4.55
*Nos. 25 and 26	3.45@3.70	4 85	4.85	6 55	4.70
*No. 28	3.75@4.00	5.15	5.15	6 85	5.00

*For painted corrugated sheets add 30c. per 1,000 lb. for 5 to 28 gage; 25c. for 19 to 24 gages; for galvanized corrugated sheets add 15c., all gages.

LINSEED OIL—These prices are per gallon:

	New York: Current	New York: One Year Ago	Chicago: Current	Chicago: One Year Ago
Raw in barrel (5 bbl. lots)	$0 72	$0 95	$0 76	$1 25

WHITE AND RED LEAD—Base price in cents per pound:

	Red				White	
	Current		1 Year Ago		Current	Yr. Ago
	Dry	In Oil	Dry	In Oil	Dry or In Oil	Dry or In Oil
100-lb. keg	12.25	13.75	14.25	15.75	12.25	14.25
25 and 50-lb. kegs	12.50	14.00	14.50	16.00	12.50	14.50
12½-lb. keg	12.75	14.25	14.75	16.25	12.75	14.75
5-lb. cans	15.25	16.75	17.25	18.75	15.25	17.25
1-lb. cans	17.25	18.75	19.25	20.75	17.25	19.25

LUMBER

Prices wholesale to dealers in carload lots, f.o.b.

San Francisco—Prices of rough Douglas fir No. 1 common, in more than carload lots:

Lumber Prices to Contractors in Yards at San Francisco

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	$25.00	$28.00	$31.00	$33.00
3x6 and 8	25.00	28.00	29.00	31.00
4x4-6 and 8	27.00	30.00	31.00	33.00
3x10 and 12	27.00	30.00	31.00	33.00
3x14	28.00	30.00	32.00	34.00
4x10 and 12	29.00	31.00	33.00	35.00
4x14	30.00	32.00	34.00	36.00

	24 Ft. and Under	25 to 32 Ft.	33 to 40 Ft
6x10	$30.00	$32.00	$34.00
6x14	32.00	34.00	36.00
8x10	30.00	32.00	34.00
3x14	32.00	34.00	36.00

New York, Chicago, St. Louis and Detroit—Wholesale prices to dealers of long leaf yellow pine.

	New York*		Chicago	
	20 Ft. and Under	20-24 Ft.	20 Ft. and Under	22-24 Ft.
3x 4 to 8x8	$38.00	$39.00	*$40.00*	$42.00
3x10 to 10x10	41.00	41.00	*42.00*	44.00
3x12 to 12x12	42.50	43.50	*44.00*	*45.00*
3x14 to 14x14	47.50	48.50	*48.00*	50.00
3x16 to 16x16	52.50	53.50	*53.00*	*55.00*
3x18 to 18x18	57.50	58.50	*59.00*	*61.00*
4x20 to 20x20	67.50	68.50	66.00	68.00

* Wholesale price to dealers; to contractors, on lighters or cars, about $5 additional. Short leaf pine up to 14 x 14 costs $15 per M. less.

St. Louis: Yellow pine, 22@24 ft. long, 3 x 4 to 4 x 4, $34.50; 3 x 6 to 8 x 8, $33; 3 x 12 to 5 x 12, $40; 3 x 14 to 4 x 14, $46; 3 x 16 to 4 x 16, $51; 3 x 18 to 5 x 18, $58.

Detroit—Norway pine 2 in. x 4 in., 10 ft. x 16 ft. long, $35, 2 in. x 12 in., 10 ft. x 16 ft. long, $37; short leaf yellow pine 2 in. x 4 in, 9 ft. x 12 ft. long, $27.50 2 in. x 8 in., 18 ft. x 20 ft. long, $31; yellow pine flooring No. 1 common 1 in. x 3 in., $39.75, 1 in. x 4 in., 6 ft. x 12 ft. long, $37.25; yellow pine shiplap $37.00.

Over 24 ft.—Add $1 for each additional 2 ft. in length up to 30 ft. for sizes 12x12 and under, for sizes over 12 x 12 add $2, for merchantable add $2 to sizes 10 x 10 and under. For pine add $2 to the price of merchantable for all sizes.

Other Cities

	8 x 8-In. x 20 Ft. and Under			12 x 12-In. 20 Ft. and Under	
	P.	Fir	Hemlock	Spruce	P.	Fir
Boston	$47.00	$52.00	$55.00	$48.00	$57.00	$52.00
Seattle	.....	22.00	.....	.....	.....	24.00
New Orleans	28.00	23.50	.....	.....	33.09	27.00
Baltimore	30.00	.....	.....	.....	32.50	.....
Cincinnati	42.00	50.00	.....	.....	46.00	64.00
Montreal	78.00	85.00	68.00	78.00	120.00	100.00
Los Angeles	.....	41.00	40.00	.....	.....	44.00
Denver	.....	33.75	.....	.....	50.00	*35.75*
Minneapolis	40.00	37.00	35.00	.....	47.00	36.00
Atlanta	30.00	.....	.....	.....	*38.00*	.....
Dallas	33.00	.....	.....	.....	37.00	.....
Kansas City	33.00	29.50	47.00	.....	38.00	33.00
Birmingham	16.00	.....	.....	.....	22@25	.....
Philadelphia	45.00	51.00	54.00	47.50	55.00	51.00

	1-In. Rough, 10 In. x 16 Ft. and Under			2-In. T. and Gr. 10 In. x 16 Ft.	
	P.	Fir	Hemlock	P.	Fir
Boston	$47.00	$48.00	$37.00	$45.00	$48.00
Seattle	.....	15.50	.....	.....	*17.00*
New Orleans, at mill	52.00	25.00	.....	32.00	.....
Baltimore	34.00	.....	.....	32.50	.....
Cincinnati	62.50	80.00	.....	33.50	.....
Montreal	120.00	60.00	60.00	80.00	80.00
Los Angeles	.....	*37.00*	*36.00*	.....	63.00
Denver	.....	*30.25*	.....	.....	*28.25*
Minneapolis	38.50	31.25	31.25	36.00	29.75
Atlanta	19.00	.....	.....	22.00	.....
Dallas	32.00	30.00	.....	36.00	.....
Kansas City	36.00	33.00	.....	32.50	31.00
Birmingham	15.00	.....	.....	15.00	.....
Philadelphia	34.00	36.00	35.00	32.50	.....

Montreal—Up to 32 ft.; over which, $3.00 per M. increase up to 30 ft.

Birmingham—Quotes carload lots, f.o.b. sidings. $2 additional per M. ft. for delivery.

Cincinnati—Prices to contractors in carload lots, f.o.b.

Denver—Quotes dealers prices to contractor on large projects.

FREIGHT RATES

On finished steel products in the Pittsburgh district, including plates, structural shapes, merchant steel, bars, pipe fittings, plain and galvanized wire nails, rivets, spikes, bolts, flat sheets (except planished), chains, etc., the following freight rates are effective in cents per 100 lb., in carloads of 36,000 lb.:

Baltimore	$0.33½	Detroit	$0.32½
Birmingham	.76½	Kansas City	.81½
Boston	.41½	New Orleans	.51½
Buffalo	.29½	New York	.38
Chicago	.38	Pacific Coast (all rail)	1.66½†
Cincinnati	.325	Philadelphia	.35
Cleveland	.24	St. Louis	.47½
Denver	1.35*	St. Paul	.66½

Note—Add 3% transportation tax. * Minimum carload, 40000 lb.
†Minimum carload, 50,000 lb., structural steel only; 80,000, lb. for other iron ro steel products.

CONTRACTORS' SUPPLIES

STEEL SHEETPILING—The following price is base per 100 lb. f. o. b. Pittsburgh, with a comparison of a month and a year ago:

Current	One Month Ago	One Year Ago
$1.80@1.90	$1.80@1.90	$4.00@$4.50

WIRE ROPE—Discounts from list price on regular grades of bright and galvanized are as follows:

	Eastern Territory New York and East of Missouri River
Hercules red strand, all construction	25%
Patent flattened strand, special and cast steel	25%
Patent flattened strand, iron rope	10%
Plow steel round strand rope	40%
Special steel round strand rope	35%
Cast steel round strand rope	27½%
Round strand iron and iron tiller	10%
Galvanized steel rigging and guy rope	12½ %
Galvanized iron rigging and guy rope	+7½%

California, Oregon, Nevada and Washington Discount 5 points less than discount for Eastern territory.

Wyoming, New Mexico and Colorado: Discount 5 points less than discount for Eastern territory.

Arisona: Discount 10 points less than discount for Eastern territory.

Montana, Idaho and Utah: Discount 10 points less than discount for Eastern territory.

North Dakota, Nebraska, Kansas, Oklahoma and Texas: Discount 5 points less than discount for Eastern territory.

MANILA ROPE—For rope smaller than ¾-in. the price is ½ to 2c. extra; while for quantities amounting to less than 600 ft., there is an extra charge of 1c. The number of feet per pound for the various sizes is as follows: ¼-in., 8 ft., ½-in., 6; ¾-in., 4½; 1-in., 3½; 1½-in., 2 ft. 10 in.; 1½-in., 2 ft. 4 in. Following is price per pound for ¼-in. and larger, in 1200-ft. coils:

Boston	$0.19	New Orleans	$0.16
New York	18½	Los Angeles	.15½
Chicago	.18	Seattle	.16
Minneapolis	.18½	St. Louis	.18½
San Francisco	.16	Montreal	.30
Atlanta	21	Detroit	.175
Denver	.18	Baltimore	.22
Cincinnati	.19	Kansas City	.17½
Dallas	.29	Birmingham	.20½
Philadelphia	.19		

EXPLOSIVES—Price per pound of dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.3075	$0.3425
Boston	.24	.275
Kansas City	.26	.295
Seattle	.1875	.2125
Chicago	.2275	.2525
Minneapolis	.2274	.2530
St. Louis	.26	.29
Denver	.2350	.2700
Dallas	.29	.375
Los Angeles	.25	.27
Atlanta	.2675	.3025
Baltimore	.2550	.27
Cincinnati	.2275	.2725
Montreal	.32	.37
Birmingham, *delivered*	.165	.205
New Orleans	.2725	.3075
San Francisco	.195	.23
Philadelphia	.2525	.2875

PILES—Prices per lineal foot, pine piles with bark on, f.o.b. New York.

Diameters	Points	Length	Barge	Rail
12 in. at butt	6 in.	30 to 50 ft.	$0.14	$0.19
12 in.—2 ft. from butt	6 in.	50 to 59 ft.	0.18½	0.25
12 in.—2 ft. from butt	6 in.	60 to 69 ft.	0.21	0.27½
14 in.—2 ft. from butt	6 in.	50 to 69 ft.	0.24	0.32½
14 in.—2 ft. from butt	6 in.	70 to 79 ft.	0.26	0.34½
14 in.—2 ft. from butt	5 in.	80 to 89 ft.	0.33	0.42

SCRAP—The prices following are per gross ton paid to dealers and producers in New York. In Chicago and St. Louis the quotations are per net ton and cover delivery at the buyer's works, including freight transfer charges.

	New York	Chicago	St. Louis
No. 1 railroad wrought	$10.50	$11.50	$13.50
Stove plate	10.50	12.00	13.50
No. 1 machinery cast	16.50	13.50	16.00
Machine shop turnings	3.00	4.00	6.50
Cast borings	3.75	5.50	8.50
Railroad malleable cast	9.50	12.50	11.00
Re-rolling rails	11.50	13.00	12.00
Relaying rails	30.00	30.00	27.00

SHIP SPIKES—Current prices per 100 lb.:

	San Francisco Galv.	San Francisco Black	Seattle Black
In.			
½	$9.10	$8.40	$8.55
⅝	8.65	6.65	8.25
¾	8.50	6.50	8.30

Pittsburgh base, $3.25@$3.40 per 100 lb.